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Louisiana Conservation REVIEW

IN THIS ISSUE

—o—

Twenty-two Years of Banding Migratory Wild Fowl at Avery Island, Louisiana

by

E. A. McIlhenny

—o—

Milestones of Progress in the Realm of Sugar

by

Robert Glenk, Ph. M.
Curator, Louisiana State Museum

—o—

The Great Lignin Mystery

by

Louis Elsberg Wise

—o—

"I Saw in Louisiana a Live Oak Growing"

by

Edwin Lewis Stephens
President Southwestern Louisiana Institute

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DEPARTMENT OF CONSERVATION

APRIL
1934

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MRS. ESTELLE COTTMAN
B. A. in Education Assistant Director, Bureau of Education

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JAMES P. GUILLOT..........Editor
N. E. SIMONEAUX..........Assoc. Editor
ESTELLE V. COTTMAN......Nat. Guar. Ed.

CONTENTS

Page
Editorial 1
Oyster Beds and Oil Wells, a Complex Conservation Problem 2
Twenty-two Years of Banding Migratory Wild Fowl at Avery Island, Louisiana 3
Chenier Au Tigre 9
The Great Lignin Mystery 12
Louisiana Live Oaks 17
Milestones of Progress in the Realm of Sugar 23
Marking Fish 30
Cone-in-Cone from Northwest Louisiana 34
The Great Migration of Birds Begins in Spring at Grand Isle 36
Photographing Nature's Miniatures 39
Snow Skis for Marshlands! 43
Louisiana Nature Guardians 44

"How's Fishing?"

"HOW'S fishing?"—one of the friendliest of all greetings, now has its especial season in Louisiana and fishing in Louisiana is usually good.

Fishing, the most democratic of all sports holds a particularly high place in Louisiana out-of-door life. Anyone who has flown over much of the state will so sharply realize the astonishing distribution of land and water, the scene from the air presenting a picture of an intricate network of bayous, river, and lakes. Louisiana could be termed a most satisfactory "made-to-order" country for fishing.

Louisiana's fishing zones regarded in broad terms fall into four great bands:

First, the offshore, clear and deep blue waters of the Gulf of Mexico, to reach which a journey of so many miles offshore is necessary that few fishermen ever even see this fascinating pelagic fauna.

Second, the shallow, warm, and usually heavily silted inshore waters where excellent fishing is to be found for reds, for speckled trout, for jacks, for tarpon, and many others.

Third, those bayous into which, at certain times and seasons, sea water enters, creating conditions which invite the presence of an extraordinarily mingled company of fresh water and salt water fishes.

Fourth, the innumerable bayous, lakes, and rivers that, throughout the year, are purely fresh and therefore give habitation to those many and interesting fishes of "sweet water." The fisherman may take the most generous choice of any or all of these.

The Department of Conservation has been ever anxious to extend all possible aid to fishermen, either in the identification of strange captures, the examination of parasitized or diseased fishes, or the provision of counsel relating to the propagation of game and food fishes, in plantation ponds. The Department of Conservation has, further, pursued the fulfillment of its wider responsibility, that of so propagating, distributing, and protecting sport and food fishes that Louisiana's excellent fishing may be preserved for future fishermen. Such fish hatchery services the Department of Conservation adequately maintains.

Throughout these coming months, with peculiar appropriateness, there will thus be heard throughout Louisiana that universal fisherman's greeting: "How's fishing?"

Flood of Refined Sugar from Outside the U. S. Keeps Men Out of Jobs!

IN CONNECTION with the article published elsewhere in this number entitled "Milestones of Progress in the Realm of Sugar", by Robert Glenk, Curator of the Louisiana State Museum, we believe the following paragraphs, quoted from a recent statement by the United States Sugar Cane Refining Industry, which operates refineries in Massachusetts, New York, New Jersey, Pennsylvania, Maryland, Georgia, Louisiana, Texas, and California, will be of interest to our readers:

"In the year 1933, Cuba alone poured into the United States 984,075,000 pounds of *refined* sugar. In addition the great quantities of refined sugar which came in from Puerto Rico, the Philippines, and other sugar producing areas, brought the total imports for 1933 up to 1,403,580,000 pounds.

"When the Tariff Act of 1922 went into effect, the Government assumed that tropical countries would supply the cane sugar industry with *raw* material, but the manufacturing operations of *refining* would continue to be done in the Continental United States—where the industry has developed through 200 years to meet the needs of the growing country. *No country can surpass the United States in moderness, efficiency and sanitary cleanliness of its sugar refineries.*

"Experience demonstrates that the cane sugar industry attains its highest development by producing *raw* cane sugar in the tropics and *refining* it in the country of consumption. This method utilizes the most efficient factors in both fields and renders the best permanent service to the public.

"The present tariff schedule gives, in effect, not only free trade to all island refiners but also a virtual subsidy to Cuba. As a result, the outside *refiners* sell within the *United States* an amount of sugar equal to

(Continued on Page 22)

Oyster Beds and Oil Wells, a Complex Conservation Problem

By
JAMES NELSON GOWANLOCH,
Chief Biologist, Louisiana Department of Conservation

A PROBLEM of peculiar importance and complexity, involving diverse and conflicting conservation interests, has arisen in Louisiana and its investigation has revealed the strange lack of essential data for its resolution. This problem is the evaluation of the effects of oil well developments with their concomitant waste products, upon oyster beds and other marine resources. It seems desirable, after over a year of the study of these problems involving field surveys, field experiments and certain analytical laboratory experiments, to set down in brief outline the ascertained categories of pollution factors involved and the indications that preliminary experiments have already clearly revealed.

Oysters, as sessile organisms in their adult development, are exposed to the influences of an environment, from which they are incapable of any locomotory escape. They may thus become, by their survival or their mortality, significant indexes of the favorable or unfavorable character of the conditions whereunder they exist.

Reports of disastrous oyster mortality came to the Louisiana Department of Conservation in January, 1933, relating to oyster production in certain coastal areas adjacent to relatively recent oil developments. A year of investigation of these conditions has revealed certain surprising, interesting and valuable facts.

It is clearly established that heavy mortality of oysters has occurred in spatial relation to oil well developments. These losses aggregate, in two of the areas concerned, at least several hundred thousand dollars and coincide in time with the predictable period of effect of oil well operations.

Oil wells, in the coastal areas of Louisiana, constitute the development of those peculiar geological structures known as salt domes. Their presence revealed by seismological exploration, such domes are drilled and numerous wells are developed on a single dome. These wells are highly variable in their production, both in quantity of oil and in proportion of oil and water. Located, as they often are, under water in shallow coastal bays or equally shallow areas of the open Gulf of Mexico, it is inevitable that unless stringent and continuous precautions be observed, the activities of this oil production will significantly modify the character of the surroundings. Briefly analyzed, this modification may be due to the following factors:

1. The increased activity of boats in the region bringing about an intermittent stirring up of the substratum. This purely physical effect may, especially in the instance of frequent and periodic use of speed boats, actually destroy organisms such as the oysters on the beds in the restricted areas concerned.

2. The escape of crude oil itself which may, through carelessness of operators, become considerable, must likewise modify the environment in no temporary manner, since, released as free oil, such oil films under the heavily silted conditions of the Louisiana coast become rapidly and intimately part of the substratum. The effects of such released oil will hereunder be briefly discussed.

3. It appears to be the history of typical oil wells that although they may begin with the production of oil alone, they may presently begin, and progressively increase, their production of water. This effluent water ("bleed water") is brought to the surface in intimate contact with the oil from which it undoubtedly derives soluble constituents of many as yet undetermined substances. Furthermore, such effluent water frequently contains relatively high concentrations of hydrogen sulphide. In the course of the present investigations, the hydrogen sulphide content of effluent water from one of such wells was found to reach 134 parts per million, whereas the hydrogen sulphide content of the sea water of unaffected areas, even where the substratum consisted of deep mud, was only 0.15 part per million. The concentration of hydrogen sulphide was used in a preliminary survey as an index of the modification of the environment and it was found to indicate a gradient in its distribution, highest in the vicinity of the oil wells (where the reading reached 0.99 in the sea water) and progressively lower as the distance increased, although the effect was still definite in areas as distant as six miles. The peculiarly indestructible character of sulphur, when it is added either to sea water or to the substratum, makes possible the progressive

(Continued on Page 47)

Twenty-two Years of Banding Migratory Wild Fowl---at Avery Island, Louisiana

By E. A. McILHENNY

I BEGAN trapping and banding migratory wild fowl in Jandary of 1912, using at first strip bands made of pure tin having a lead seal. These were private bands and, although a large number of them were placed on ducks of various kinds, not very many returns were received; I think largely due to the fact that the bands were private.

On February 14, 1916, I began using bands sent its members by the American Bird Banding Association, whose headquarters were in the American Museum of Natural History, New York.

In 1921 the work of the American Bird Banding Association was taken over by the United States Bureau of Biological Survey, and from then until now I have cooperated in bird banding work with the U. S. Biological Survey. My complete records go back more than twenty years, and in that time much valuable data on the life-history of our wild fowl has accumulated.

Edward McIlhenny Banding Pintails. Februeary, 1934.

Of migratory wild fowl I have banded twenty-one-thousand, nine hundred and ninety-six between January, 1912 and December 31, 1933, covering nineteen species as follows: Greater Scaup, Lesser Scaup, Ring-Neck, Widgeon, Gadwall, Mallard, Mottled Duck, Dusky Duck, Pintail, Blue-Winged Teal, Green-Winged Teal, Spoonbill, Red-Head, Canvasback, Wood Duck, Florida Gallinule, Coot, Blue Goose, Lesser Snow Goose.

From these banded fowl there has been returned from birds killed or otherwise captured, up to December 31, 1933, 2,116 bands. These returns cover pretty well all of North America.

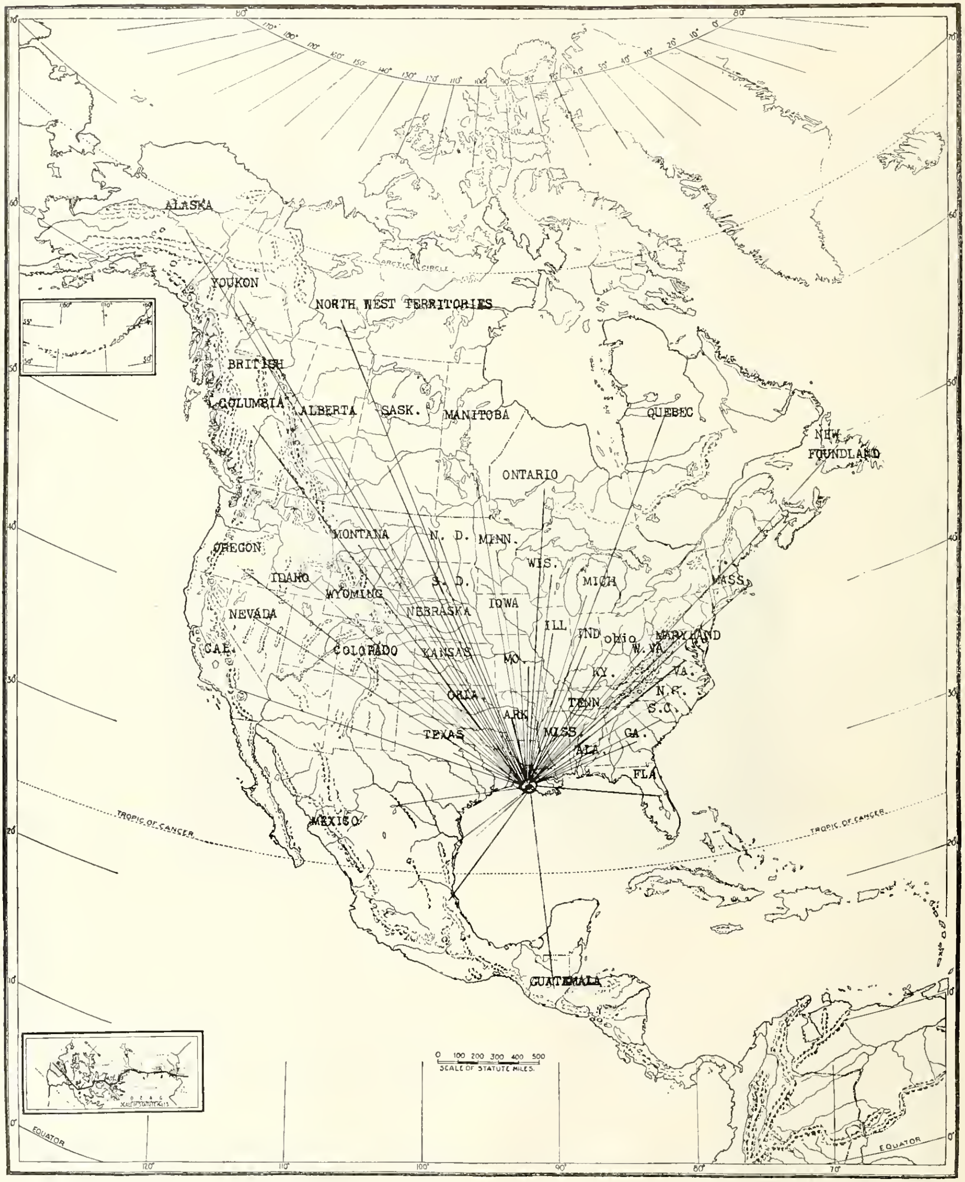
Bands having been returned from thirty-three States as follows: Alabama, Arkansas, North Carolina, South Carolina, Colorado, California, North Dakota, South Dakota, Florida, Georgia, Illinois, Iowa, Indiana, Idaho, Kansas Kentucky, Louisiana, Missouri, Minnesota, Mississippi, Maryland, Michigan, Nevada, Nebraska, Oregon, Oklahoma, Ohio, Texas, Tennessee, Virginia, West Virginia, Wisconsin, Wyoming, various parts of Alaska.

Then provinces of Canada including: Alberta, Manitoba, Northwest Territory, Ontario, Saskatchewan, Quebec, Yukon Territory, Chipinyan, British Columbia, Newfoundland.

Four Mexican States: Matamoras, Coahuila, Campeche, Laguina Palos Prietos, and Guatemala.

The usual conception of bird migration is a north and south movement. If this were strictly true it would be expected that the bulk of the wild fowl banded at Avery Island, La., would on their journey to the northern nesting grounds follow rather a narrow territory and would follow about this same territory on their return from the North to their wintering grounds South. A study of the accompanying chart will show that bands taken from wild fowl banded at Avery Island, La. have been returned from a territory covering the breadth of the lands from the Atlantic to the Pacific Ocean, and from the Arctic to the Tropics; showing conclusively that Louisiana is the focal point to which a large part of the wild fowl of North America come in Winter.

The greatest number of wild fowl banded in



Map 132—Copyrighted. The Historical Publishing Co., Topeka, Kansas.

Distribution of Returns from Ducks Banded at Avery Island, Louisiana.

any one year was 6,126 in 1933, and 1932 was a close second with 6,091 wild fowl banded.

The greatest number banded in any one day was 1,514 on December 12, 1933, but I have banded in excess of five hundred on many days.

The value of wild fowl banding is:

First, to determine the length of life of the bird. Second, to determine the territory covered by the different species in relation to the locality where banded. Third, to determine the sex ratio.

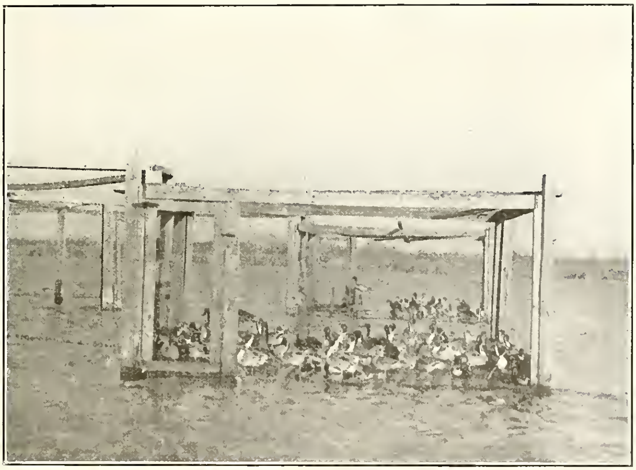
The oldest return band was taken from a Lesser Scaup hen, banded December 29, 1922, and killed during the Fall of 1932, at Clearwater, Manitoba.

Other long lived birds were:

Louisiana Heron No. 36191, banded May 2, 1921, was caught in trap February 11, 1931, at Point Aux Feu, Louisiana.

Ring-neck drake, banded February 15, 1922, was killed October 25, 1931, at Firma, Missouri.

Green-winged Teal drake, banded March 4, 1922, was killed February 2, 1930, at Coahuila, Mexico.


A Catch of 163 Pintail Ducks. February, 1934.

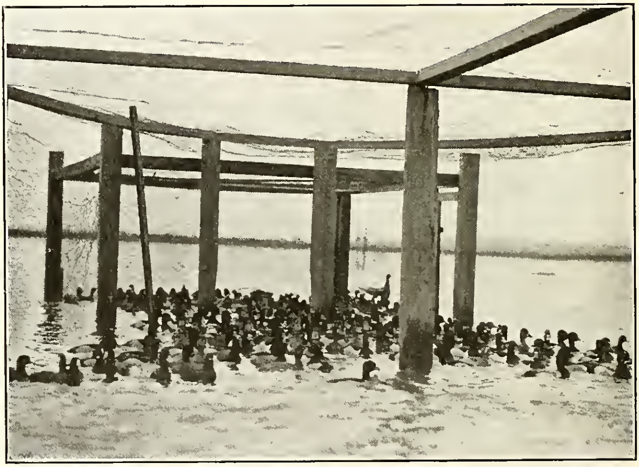
As migratory wild fowl banded in Louisiana must go North to nest, and then come South for the Winter, this means that for every year a duck that I have banded lives, it has run the gauntlet of the gunners of the Country from Canada to the Gulf twice—once up and once down. The Lesser Scaup that lived for ten years after being banded went through the barrage twenty times—ten times up, ten times down. I wonder how many times it has been shot at.

One of the most interesting things brought out by my banding operations, has been to learn how true migratory wild fowl are to their original migration routes. Since 1917, I have from time to time shipped ducks taken and banded at Avery Island, Louisiana by express to the Pacific Coast and to the Atlantic Coast where they were liberated by operators of the United States Biological Survey, to determine whether or not these birds had the homing instinct such as is shown by the Carrier Pigeon. There are three great fliways which are used by wild fowl in their journey to and from the breeding grounds of the North, and to and from the wintering grounds of the South. The greatest is through the central part of the Country between the Allegheny Mountains on the east and the Rocky Mountains on the west, and is known as the Mississippi Valley Migration Route. The next largest is along the Atlantic Coast from the breeding grounds of the North following east of the Allegheny Mountains, known as the Atlantic Coast Migration Route. The third is west of the Rocky Mountains along the Pacific Coast following the Pacific Ocean, and known as the Western or Pacific Coast Migration Route.

Of the two hundred and seventy-six banded ducks sent by express from Avery Island to Pacific Coast points and there liberated, forty-nine have been retaken. Forty of these returned to the Mississippi Valley Route, and nine were taken along the Pacific Coast. From the one hundred and sixty-four banded ducks sent to the Atlantic Coast and there liberated, forty-one bands have been returned. Thirty-nine of these returns have been from the Mississippi Valley Migration Route, and two from the Eastern Route; showing definitely that the great majority of the birds sent out of their home migration route and liberated in the eastern and western migration routes, return to the migration route from which they were taken, which is their home route.

One of the most unusual returns from any banded duck was, Pintail No. A658600, banded at Avery Island, February 14, 1930, and sent for liberation to the Biological Survey at Washington, D. C. This bird with many others was liberated on the Potomac River near Washington, and killed at Gustine, California November 2, 1932, at a point on the Pacific Coast almost opposite the point on the Atlantic Coast where it was liberated.

In their natural state almost all birds are monogamous. It is, therefore, logical to assume that nature will produce an exact numerical quantity of the sexes in birds as it does in mammals. This supposition has been borne out by the careful investigation of the sex ratio in domestic fowl by competent observers, who show less than 2% difference in the sex ratio. An amazing fact brought out by my banding records is the great predominance of males over females in many species of wild fowl. This statement would have but little weight if it were made with the records of only a few trappings covering one or two years to substantiate it, but with a record of more than twenty years to build from, covering hundreds of trappings, made from early Fall to late Spring each year, a record is built up that is indisputable.



A Catch of More Than 600 Mixed Ducks for Banding. February, 1934.

During the past twenty years I have kept a careful record of the sex of each duck banded, and a study of these records shows that the males are greatly in excess of the females in all varieties of ducks that I have handled in sufficient numbers to build up a real record.

Of Lesser Scaups I have banded 6,159, and the males exceed the females 2 1/2 to one.

Of Pintails I have banded 7,067, and the males exceed the females 4 1/2 to one.

Of Ring-necks I have banded 913, and the males exceed the females 4 1/2 to one.

Of Blue-winged Teal I have banded 992, and the males exceed the females 4 1/5 to one.

Of Canvasbacks I have handled 461, and the males exceed the females 4 1/2 to one.

This excess of males over females is a real factor in the decline of our duck population, in some species at least. First, because the unmated males will, undoubtedly, greatly harass the nesting females, often causing a breaking up of the nest. Second, because there is such a considerable excess of males, the breeding stocks of our ducks is much smaller than an observer would suppose, when seeing large flocks of these birds.

In order to give the reader an idea of the great distances covered by ducks on their northern journey from Louisiana, the following records are given:

Lesser Scaup No. 35832, banded Feb. 14, 1916, was killed at Ft. Smith Northwest Territory, Canada, May 26, 1919. 2,875 miles from the place banded.

Mallard No. 36164, banded April 8, 1918, was killed at Johnston, Saskatchewan, Canada, October 13, 1918. 1,667 miles from the place banded.

Ring-neck No. 101,407, banded Feb. 17, 1922, was killed at Cross Lake, Saskatchewan, Canada, May 12, 1923. 2,242 miles from the place banded.

Blue-winged Teal No. 504165, banded Nov. 23, 1922, was killed at the east side of Lake Manitoba, Manitoba, Canada, Sept. 16, 1923. 1,610 miles from the place banded.

Pintail No. A666191, banded Jan. 3, 1931, was caught in trap at Quithlook, Alaska, May 18, 1932. 3,565 miles from the place banded.

Coot No. A666392, banded Jan. 26, 1931, was killed at Bay DeVerde District, Newfoundland, Sept. 29, 1931. 2,357 miles from the place banded.

Pintail No. A666445, banded Jan. 31, 1931, was caught at Dillingham, Alaska, in the Spring of 1931. 3,622 miles from the place banded.

Pintail No. A658851, banded Feb. 18, 1931, was killed at Selawik River, Alaska, April 12, 1931. 3,507 miles from the place banded.

Lesser Scaup No. B632931, banded Feb. 3, 1932, was killed at Northwest Territory, during the Fall of 1932. 2,817 miles from the place banded.

Green-winged Teal No. 50440, banded Dec. 26, 1922, was killed at Alberta, Canada, Sept. 1, 1923. 2,127 miles from the place banded.

Pintail No. A658863, banded Feb. 18, 1931, was killed 30 miles north of Old Crow Village, Yukon Territory, Canada, Sept. 3, 1932. 3,162 miles from the place banded.

It is an interesting fact that banded birds have no fear of the traps in which they were caught, and this is true of both the wild fowl and the smaller migratory birds; they return to the traps and are taken over and over again often during the same day, and return to the place where they were banded year after year.

For instance:

Coot No. A658025, banded Dec. 29, 1929, was retrapped in the same trap Dec. 16, 1931, Jan. 19, 1934.

Coot No. A665698, banded Nov. 15, 1930, was retrapped in the same trap Dec. 20, 1932, Jan. 25, 1933 and Jan. 19, 1934.

Coot No. A629279, banded Feb. 16, 1929, was retrapped in the same trap Feb. 16, 1932, Jan. 31, 1934.

Pintail drake No. A666746, banded Jan. 6, 1931, was retrapped in the same trap Dec. 7, 1931, Dec. 20, 1932, Dec. 22, 1933 and Jan. 31, 1934.

Coot No. A658126, banded Dec. 20, 1929, was retrapped in the same trap Nov. 5, 1930, Feb. 16, 1932, Dec. 20, 1932 and Jan. 31, 1934.

Coot No. A666140, banded Dec. 29, 1930, was retrapped in the same trap Jan. 28, 1932, Feb. 16, 1933 and Jan. 31, 1934.

I operate for my banding of the migratory wild fowl two large permanent, wire-covered traps, measuring 50x50 feet, with a receiving cage 10x10 feet on each side, and connected with the main trap by a wire V. These traps are baited with three hundred pounds of rice each morning, from the time the ducks arrive in the Fall until they leave in the Spring. The traps are set up usually one day a week. After the first four or five bandings, banded ducks taken in the traps greatly outnumber the unbanded ones. I frequently get ducks that were banded in the morning back in the trap the same day, and by the first of February, the banded birds so greatly outnumber the unbanded, at each setting of the trap, that it is no longer of any use trying to band; for sometimes I will have to handle more than two thousand banded ducks to get one hundred unbanded ones, and the banded birds knowing the grain is spread at a certain time, go into the traps as soon as the man who spreads the grain leaves, and eat it all up before the other birds get a chance to feed.

For small birds I have a series of small traps set at widely scattered points, often two miles or more from the station where the actual banding is done. These small traps, when set, are tended by men who make the round of them all, several times a day; bringing the birds taken in the traps in transfer cages to the station where the actual banding and recording is done. It is not unusual for small birds, such as Sparrows, Cowbirds, Red-winged Blackbirds and Grackles to be retaken from the same trap in which they were caught in the morning, several times during the same day, although the trap may be as much as two miles from the point to which the bird was brought for the putting on of the band. Proving that birds have a keen and immediate sense of location, and return, when liberated, at will to the location from which they may have been forcibly taken.

I have found trapping ducks and other migratory game birds and the smaller non-game migratory birds, for banding purposes, comparatively easy, but when I was requested by the Biological Survey to try to band Blue Geese, I found I was up against a hard task. The Biological Survey had previously sent two expeditions to Louisiana for the purpose of banding Blue Geese, but not a single goose was captured. First, I tried, without success, baiting with grain areas where the Blue Geese came regularly as they would not eat the grain, preferring the natural food of which there is an unlimited supply in the marshes along the coast of Iberia and Vermilion Parishes. Then, I tried using live Blue Goose decoys to see if the geese would come to them, and found the wild birds came to them readily. I then built in the centre of one of their principal feeding grounds on my land at Cheniere au Tigre on the coast of Vermilion Parish, a pear-shaped poultry wire fence three hundred feet across, tapering at the smaller end to a wire-covered pen fifty feet square; the front of which faced and connected with the small end of the large enclosure. Into the large inclosure I put about sixty wing-tipped Blue Geese, and had them trained to drive easily into the covered pen. My expectation was that from the hundreds of thousands of Blue Geese that would feed near and fly over this inclosure, a good many would alight with the decoy geese and follow them into the covered pen, where they could be caught and banded.

I built a small camp near the pen and stationed there two men who had been trained for years in assisting me in my work of banding wild fowl. These men faithfully tended this pen for sixty days, but only captured one hundred and seven Blue Geese and seven Lesser Snow Geese. Great numbers of geese lit in the pen with the decoys and would follow them as they were slowly driven towards the covered pen, but only an occasional wing-free goose would go inside. They almost always stopped as soon as they saw the wire over-head, and flew away. So this attempt was without much success.

During the late Summer of 1933, I covered the bottom of a small shallow pond in the centre of the Blue Goose feeding territory with fine gravel, knowing that once geese found where gravel could be gotten they would go to it regularly. Having procured a lot of very small steep traps to which light weights were attached, I, after the geese began coming regularly to the graveled pond, had my chief warden, Lionel LeBlanc, build a blind of the native grass on the edge of the pond, and after setting a number of the traps, he would get into the blind to wait results. In this way he caught in a few days one hundred and fifty-two Blue Geese and nine Lesser Snow Geese; all of which were banded and liberated at once. From this entire lot only one was injured, as the traps were so small that the geese were caught by the toes only, and as they were only in the traps a few minutes, the toes would not even be bruised severely. This is by far the easiest way to capture Blue Geese for banding.

A few Blue Geese come in with my decoys at Avery Island each year, and these become so tame that the man in charge often catches them with his hands, while feeding the other geese. For after they learn to eat grain, they will come to his feet if he spreads grain around him, and he only has to make a quick grab to catch them.

The 1933 crop of Blue and Lesser Snow Geese was exceptionally heavy, as there were more young birds showing in the flocks than I have seen for many years.

When the geese first arrived in early November, 1933, not much of the three-cornered grass—on the roots of which they feed—had been burned, and as the grass was unusually high and thick, the geese often mashed down small areas and would then tunnel in under the standing grass to feed on the roots. Two of my men, Aras Guidry and Lionel LeBlanc, found that by walking as closely as possible to these feeding geese and then running at them, they could catch some of the geese with their hands before they could take wing, and in this manner they caught quite a number, but as it seemed to frighten the geese, I had this method stopped.

The percentage of bands returned by sportsmen in relation to the number of ducks banded is an indication of the percentage of the wild fowl population actually killed by the hunters of the Country. I think, fully 50% of the banded birds shot are reported to the Biological Survey. If this be true, from my banding of 21,996 wild fowl, there has been returns of 2,116 or 10%. Ths indicates that not more than 20% of the wild fowl supply is killed by hunters. If there is a larger reduction annually of the wild fowl supply, it must be from other causes than shooting.

The great concentration of wild fowl in the low lands of Louisiana in winter makes it imperative that the Federal Government establish additional feeding and resting grounds where the birds will not be disturbed in this State.

ADDITIONAL POLLUTION REGULATIONS PRESCRIBED BY COMMISSIONER OF CONSERVATION

General regulations issued by the Louisiana Department of Conservation, September 28, 1933, *"prohibit the pollution of public waters in the State of Louisiana".*

Attention is invited to the fact that pollution of navigable waters by oil constitutes a violation of the Federal "Oil Pollution Act", approved June 7, 1924 (Stats. L., Vol. 43, pp. 604-606).

The Louisiana Department of Conservation will immediately report to the proper United States government officials for appropriate action under the above named law, any pollution observed in navigable waters.

The following are *special* rules covering a definite type of pollution which necessitates immediate control by violators:

Rule 3. *CONSTRUCTION OF WALL TO PREVENT POLLUTION*: All persons, firms, corporations, or operators, producing oil in the tidal marsh or fresh water swamp areas in the State of Louisiana, shall be required to construct a wall, composed of impervious material, surrounding each producing well, each relay station, each storage tank, and each loading rack. This wall shall be constructed so as to prevent any oil from escaping either beneath or above such wall. This wall shall be constructed to such a height so as to prevent high tide or overflowing waters from flowing over into the inside of such wall.

Where such operations are located on dry land, it will be necessary for the operator to construct a levee of sufficient height around each producing well, relay station, storage tank, or loading rack in order to prevent any oil from escaping or overflowing in such localities.

Rule 4. *DRIP PAN UNDER EACH DERRICK LOCATED IN WATER*: All persons or operators having derricks, used in the drilling of wells, for oil, natural gas, sulphur or other minerals, located in swamps, tidal marshes or fresh or salt water bodies, shall be required to prevent the waste of oil used for lubricating purposes. A

(Continued on Page 11)

Chenier Au Tigre

By
ALFRED M. BAILEY
The Chicago Academy of Sciences

THE Louisiana Gulf Coast is well known to many of us as a wintering resort: we look forward to days when we may paddle our pirogues along winding bayous, when we may wade waist deep across the endless marshes or wander to our heart's content along the sandy ridges bordering the Gulf of Mexico. These highlands, crowned with their wonderful moss-festooned live oaks, the palmettoes and mesquite, are the homes of a kindly people, for the most part descended from the Acadians who were banished from their homes in Nova Scotia so many years ago; they have set up their little communities, apart from the world and carry on, much, I have an idea, as did the inhabitants of Grand Pré in days gone by. At any rate, Longfellow's lines: "Bearded with moss, and in garments green, indistinct in the twilight," remind me more of Louisiana than the cold shores of the North Atlantic.

Chenier au Tigre

It has been a long time since I first visited Chenier au Tigre in Vermilion Parish, that five mile strip of beach with its grand growth of gnarled oaks, and became acquainted with the people who dwell there in peace and comfort. And for many years, more than I like to think about, I have been returning to enjoy the kindnesses of the hospitable Sagregas, Simmes and Mrs. Simmes. I wonder how many hundreds of visitors have put their feet beneath that loaded table and were thankful for the kind providence which has blessed the people of Southern Louisiana with such a wealth of seafoods which is theirs for the gathering; and were glad to have such kindly hosts to impose upon?

Oaks and Palmettoes—Chenier au Tigre

I like the Chenier in the early spring when the mesquite is in new leaf and the whole world smells of fresh growing vegetation. Prickly pears are massed along the exposed sandy ridges and their yellow wax-like blossoms are opened in the sunlight with petals invitingly outstretched to welcome the bees which are so seriously attending their own affairs. The mesquites are alive with small perching birds which have just arrived from South America; the winged strangers work busily through the dense vegetation, in search of food—they linger for days in the hospitable region, as they gather strength after their arduous flight across the Gulf—and then they pass on to their northward nesting grounds. All along the beach where the warm on-shore winds send waves rippling over the sands, are many species of shore birds. The black bellied plover

Opossum, Common Folks of the Chenier

(the *pigeon de mer* of our French-speaking friends) is one of the most conspicuous, a plump, good sized fellow who shows a band of black beneath his wings when he takes off across the Gulf; while the willet is the most querulous of all. He is no retiring fellow. He comes to greet an intruder in his domain, and, if spring is well advanced, and there happens to be a set of protectively-colored eggs hidden away beneath tangled grasses, he will poise in the air on outstretched wings and hurl invectives which no self respecting bird should use.

Back of the ridge, extending miles to the northward are the great marshes. Seaside sparrows and long-billed marsh wrens nest in security in the mats of grass, and yellow throated warblers, kingbirds, and orchard orioles make their homes in bushes along the banks of meandering bayous. Spring fades into summer before one is aware, for marsh flowers begin to bloom early in the year, and when the heat of midsumer is over the land and water, the flowers are still blooming. White-faced water lilies crowd marsh ponds—miles of flowering gardens which are rarely seen by man. But possibly the boat-tailed grackles, the gallinules and the rails appreciate the beauties of the flowering water plant.

Then, after the heat of the summer is past, a few ducks make their appearance in the fresh water ponds, and wedge-shaped flocks of geese come pouring out of the northern sky to seek food and safety in the wide savannahs near the Chenier. The arrival of the geese is not a sign of cold weather to the northward; they have not been driven south by frozen ponds and shortage of food for there are thousands of miles of suitable country between their breeding grounds and Louisiana. They simply take leave of their summer homes in far off Baffin Land at a given time, and the thousands upon thousands of Blue, with a sprinkling of Snow Geese, make an almost direct flight to the Louisiana Gulf Coast. Few gunners have an opportunity to ambush them en route for they fly day and night, rarely coming within gun shot of the earth until they reach the shores of the Gulf.

The Blue Goose is exceedingly abundant in

Blue Geese. Photograph Taken on Land of E. A. McIlhenny. Credit—Chicago Academy of Sciences.

Southern Louisiana, several great bands wintering between the mouth of the Mississippi on the east and the Sabine on the west. An enormous flock dwells in the marshes off Main Pass, at the mouth of the Mississippi, another on Marsh Island to the eastward of the Chenier, while to the westward are other great flocks near Grand Chenier and in Cameron Parish. The geese wintering in the vicinity of Chenier au Tigre are particularly favored for they find an abundant supply of the three-cornered grass which is their main source of food—there is gravel in various places—and there are protected areas where they may feed undisturbed by hunters. The Louisiana Department of Conservation has taken a deep interest in the protection of these winter guests for it has the State Wild Life Sanctuary upon which many are found. Adjoining their area is the 26,000 acre Paul J. Rainey anctuary, which is controlled by the National Association of Audubon Societies, while next to that is a vast tract owned by E. A. McIlhenny.

The geese congregate in enormous flocks on these lands, and when the hordes are contentedly feeding, it is posible, with a favorable wind, to hear their contented murmurings for five miles. An occasional trapper crosses their domain from time to time and the masses of white-headed geese rise when he approaches too closely; they appear a black mass in the sky, and then swirl down to a new feeding spot a few hundred yards away.

Occasionally for no reason at all, apparently, the geese will leave this pasture or the adjacent Rainey sanctuary for the day. They probably have a desire for gravel; at any rate they rise in small bands of fifty or a hundred, mount into the sky, and flock after flock will trail off to the eastward, their resonant musical voices being audible long after they have disappeared from view.

But they are sure to return to the safety of these sanctuaries in the evening. Long before the sun has dipped below the glistening rim of the Gulf, they begin to appear, first as mere specks in the grey, and then flock after flock of calling birds. They fly high until directly over their favorite haunts, and then swirl down in funnel formation, an endless chain of geese which enlarges the flock upon the ground until the white heads of the birds make the marsh seem as though covered with snow.

Mr. F. R. Dickinson, vice-president of the Chicago Academy of Sciences, and I have made many field trips to the Chenier and its vicinity to secure motion films of the interesting animal life for the film library of the Academy. We have spent days with the hospitable Sagreras—sometimes just enjoying the balmy air of the Gulf coast, but usually wandering far afield with our cameras.

I am sure there are no flocks of geese elsewhere in North America, of any species, as are found of Blue Geese in these Louisiana coastal marshes, and yet, although so common in lower Louisiana, they are known to comparatively few naturalists. This seems strange at first but, when we consider that they have such limited wintering grounds and an almost unknown breeding place, far north of the Arctic Circle, it is not hard to understand.

It should be emphasized that in spite of the abundance of Blue Geese, their number would be woefully depleted if they were not protected upon these reservations; the Blue Geese have the distinction of being the only migrating game birds in North America which have successfully held their own—and they need the protection given them.

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ADDITIONAL POLLUTION REGULATIONS

(Continued from Page 8)

drip pan or catch basin of galvanized iron shall be placed under the floor of each derrick, and all machinery of the drilling rig, in order to prevent the slightest quantity of oil from falling, dripping, or wasting into the water body.

If a steel barge, equipped with a derrick and drilling machinery, is used in the drilling of wells, these drilling barges shall be constructed so as to prevent the slightest quantity of oil, used for lubricating purposes, from falling, dripping, or wasting into the water body.

Rule 5. *DRIP PAN UNDER EACH BOILER*: All persons or operators drilling for oil, natural gas, sulphur or other materials, whose operations are located in fresh or salt water bodies, and who use oil for fuel, shall take the necessary precautions to assure the Commissioner of Conservation that no oil be wasted into the water bodies. The operator shall have a drip pan or catch basin of galvanized iron placed under each boiler which is using oil for fuel, in order to prevent the slightest quantity of oil from falling, dripping or wasting into the water body.

The foregoing are promulgated as regulations of the Department of Conservation, State of Louisiana, under authority of Act 127 of 1912, and hereby adopted effective April 15, 1934, the provisions of which are to be complied with within ten days from the date of its adoption.

State of Louisiana, Department of Conservation

By Robert S. Maestri, Commissioner.
April 5, 1934. James P. Guillot, Secretary.

Submitted and approved, Louisiana Department of Justice, James O'Conner, Assistant Attorney General.

The Great Lignin Mystery*

Uncovered Years Ago in Paris, the Unsolved Problem of the Great By-product of Field and Forest Still Puzzles Chemists of To-day

By Louis Elsberg Wise

THE casual tourist, wandering through the gray, ancient *quartier* of Paris, near the Porte St. Denis, may be surprised to see sprawling before him a massive, sombre old building. This is the Museum of Arts and Crafts, landmark of France's accomplishments in engineering and industry. Let him wander through the portals of that huge vault and he will view with delight well planned exhibits, historic apparatus and equipment, and delicate, precise miniature models of all types of machinery. It is doubtful, however, if he will stumble upon the bust of a chemist long dead and forgotten, who worked in the laboratories there a century ago. This bust, grimy and inconspicuous, commemorates the work of old Anselme Payen, who first uncovered the great lignin mystery in 1838. Payen had always taken a special interest in the chemistry of woody plants. He had treated wood with most of the reagents standing on the shelves of his dingy laboratory—alcohol, ether, acids and alkalies. And as a result of this insatiable curiosity he found that all the woods yielded the same resistant, fibrous substance known as cellulose—the substance which in one form or another enters the paper, rayon, cellophane, textile, explosive, lacquer and photographic industries of today. At the same time, Payen made another interesting though less sensational discovery. He found that in isolating this cellulose, in separating the tiny, individual cells from each other, he was always forced to remove—often to change or destroy—other components of the wood. These weaker, less resistant substances, which he christened *les matieres encrustantes,* cemented together millions of cells in the bole of the tree, and also reenforced the cellulose within the individual cell. *Les matieres encrustantes* were later renamed "lignin."

Anselme Payen,—the French chemist who first uncovered the great lignin mystery. (After a photograph by Pierre Petit).

Payen studied his lignins patiently and tenaciously. Like all good chemists he strove to penetrate into the architectural pattern of the lignin molecule. There were only three distinct types of atoms present—carbon, hydrogen, and oxygen. Unfortunately, however, the molecule was built up of scores of these very atoms, and the permutations and combinations were baffling. So Anselme Payen failed, but it was a noble defeat after an exhilarating struggle. Scores of chemists since his day, equipped with far better and more delicate tools, have wrestled with the same problem with equal futility. Nearly a hundred years have gone by, and the mystery of lignin still lies well over the horizon.

Why then should lignin interest or disturb the layman? This question is best answered with a few bold statements. Lignin is one of the greatest chemical by-products that the forests have to offer us. Twenty to thirty per cent of dry wood is made up of lignin. It is one of the largest agricultural wastes in the world. From fifteen to twenty-five per cent of those wastes is composed of lignin. Considering the combined losses from pulp mills and agricultural products, probably forty million tons of lignin are lost annually in the United States alone. When, to this conservative statement, are added the facts that lignin, like cellulose, is an end-product of solar energy, free from tariffs and taxes, growing without benefit of technologist or technocrat, that it has a much higher fuel value than that of cellulose, that it is the probable forebear of soil humus, of peat, of lignite and of certain coals, and that it contains chemical groupings that point strongly towards its industrial usefulness, the reader will be alive to its present and future importance.

Forty million tons of waste lignin! What is it chemically? By what complex mechanism is it

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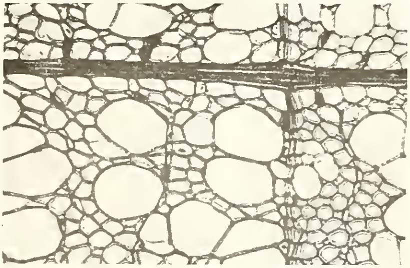
*Courtesy "American Forests", Washington, D. C.

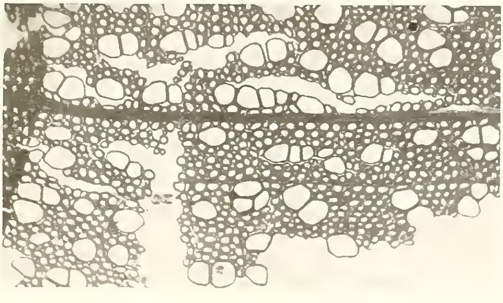
produced in forest and field? What use can be made of it? How should it be disposed of? Those questions probe the heart of the lignin mystery as it appears in 1933. There is no object in reviewing the progress made by chemists in grappling with the structure of the intricate lignin molecule. No need to relate how a clue here, a blazed trail there, have led them through a bewildering labyrinth of studies in the laboratories of America, England, Germany, France, Scandinavia, or Japan; or how chemists, through the use of improved instruments, have found that the lignins from straws, despite their kinship, are different from those of the softwoods. How these, in turn, differ subtly from those of the hardwoods. How *all* lignins have certain characteristic earmarks, certain tell-tale groups in common. It has been a gruelling, difficult struggle, with the end not yet in sight. Suffice it to say that the "century of progress" has been a worthy, not a wasted one.



William M. Harlow.

A minute, thin section of untreated Basswood, (Magnified 150 times). Note its architecture under the microscope.

Looking at the more practical aspects of the lignin problem, has that enormous waste tonnage found any use at all? The answer, hedged in with all sorts of reservations, is a qualified "yes." Lignin is being used by industry, but its uses are crude and primitive, and they account for only a small fraction of the product which accumulates from year to year. Often they depend on the physical rather than the chemical character of the substance. Its few purely chemical uses literally batter the lignin molecule to pieces. For example, in the destructive distillation of wood, methanol (wood alcohol) emanates from the lignin. Wood cellulose and the other constituents of the wood when heated fail to give this product. But in the process of menthanol formation, the constitution of lignin is hopelessly shattered. Besides, methanol is now produced very economically and efficiently by synthetic means from hydrogen and the poisonous carbon monoxide. In fact the synthetic product actually exceeds in amount the methanol formed by wrecking lignin. To the chemist there appears to be a parallelism between the lignin situation of 1933 and the good old days when coal tar was exploited with equal crudity, just before it was known to yield hundreds of brilliant dyes, valuable drugs, high explosives, powerful preservatives, potent disinfectants, and intriguing perfumes.



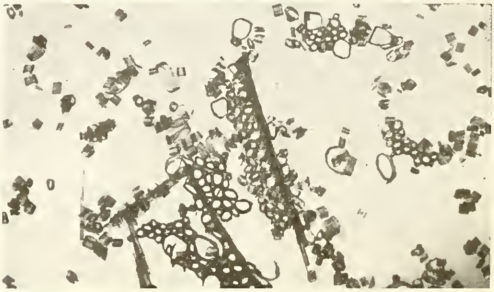
William M. Harlow.

Basswood,—watch the process of chemically delignifying the original wood. Individual cells are being loosened from each other, as the lignin dissolves. (Magnified 75 times).

Despite their obvious drawbacks, the industrial functions of lignin merit attention. In all phases of the lumber industry lignin remains part and parcel of the final product. In groundwood pulp, an important raw material for newsprint paper, lignin is always present. Here, however, it makes for neither durability nor strength. Sunday editions of the metropolitan dailies fall to pieces rapidly in the hands of the omnivorous readers. One of the factors responsible for this impermanence is the lignin hiding within their short-lived pages. Special deluxe newspaper editions, free from all lignin, have been introduced. High grade magazines furnish their subscribers regularly with a much stronger pabulum. Their dignified pages are almost completely delignified, and hold their own against time and harsh treatment.

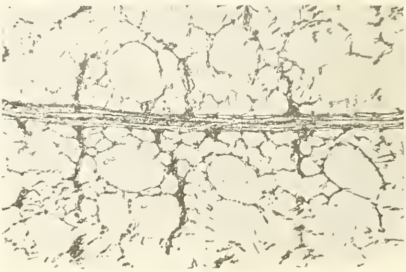
Of course the permanence of paper does not depend exclusively on the absence of lignin. Far from it. The length and strength of the cellulose fibers, the type of cellulose used, and its chemical pretreatment in the process of manufacture, are all very important factors. On the other hand, lignified raw materials have never been an answer to the papermakers' prayer, and lignin has always been an expense and a sort of *bete-noire* to the paper industry.

Hence in the production of chemical pulp, by any of the processes used today, lignin is largely removed, and the residual cellulose fibers play the trustworthy role of a well-behaved raw material. No matter what chemical means is used in converting wood into pulp, the principle remains essentially the same—get rid of the lignin as far as possible, but be careful not to hurt the cellulose. In these chemical treatments, what is the ultimate fate of lignin, step-child of the paper industry? As an example, take the case of sulfite pulp production. Here spruce chips are "cooked" under pressure with liquors containing sulfurous acid and calcium bisulfite, in huge acid-proof digesters. Suffice it to say that it effectively removes the lignin from the cellulose. Later, in the "waste liquor" are found certain sugars—degradation products of the original wood—but their main component is lignin, sadly changed but still recognizable. In some obscure fashion it has combined chemically with the sulfur and the lime during the "cook," and thenceforth it masquerades under the name of *calcium lignosuffonate.* The chemist hasn't quite decided just what this name really means. What he does know is that in the United States and Canada some two million tons of this product are manufactured every year, and that no one knows what to do with most of it. Dr. Henry K. Benson, in a recent treatise on the chemical utilization of wood, compiled for the Department of Commerce in 1932, says: "The obscurity of the lignin structure is perhaps the greatest handicap in drawing up an intelligent program of research for its conversion into marketable products."



William M. Harlow.

A photomicrographic study of a later stage in the removal of lignin "cement." Disintegration follows, and the remains consist largely of cellulose.



William M. Harlow.

Basswood lignin. The result of treating this wood with sulfuric acid. The useful cellulose dissolves. The lignin mystery remains, a filmy shadow of the original wood. (Magnified 150 times).

Despite the brilliant efforts of the chemical engineers the waste sulfite liquor, alias *lignosulfonate,* still finds its way into the sewer. Smaller streams are still polluted with the effluents from pulp mills. Fish are killed. Offensive, mephitic algae still grow at the expense of this great national, organic waste.

The picture should not be painted in too sombre a tone. There are flecks of sunlight. In Wisconsin, through the efforts of G. C. Howard, they have discovered that the waste liquors may be fractionally precipitated by means of lime. Such treatment yields: calcium sulfite,—which may be used over again in fresh cooking liquor—lignin, that can serve as fuel, and a solution of sugars and salts which may be run into the river without serious damage to the fish. Apparently the operation may be carried on without financial loss, and perhaps, at some small profit.

This is one of the many hundreds of schemes to prevent sulfite wastes from injuring and clogging the smaller waterways of the Western world. As early as 1886, several patents, British and German, sought to correct the pernicious influence of pulp mill effluents. Several countries had already enacted laws against the waste sulfite nuisance. In 1898, when the German plants at Unterkochen and Wolfash offered a cash prize to the man who could render harmless their tide of sulfite waste, eighty-three chemists and engineers came to the rescue with clever suggestions,—most of which were entirely impracticable. In 1919, articles and patents on the waste sulfite liquor problem had accumulated to such an extent that the Canadian Forest Products Laboratory filled a monograph of 190 pages in briefly reviewing the literature on the subject.

Nevertheless, calcium lignosulfonate has a few promising uses. Take its road binding property as an example. The adhesive qualities of concentrated waste sulfite liquor were recognized fifty years ago. Ullmann, an Austrian chemist, proposed in 1890 its use in briquetting wood, coke and coal. Since that day sulfite binders have appeared on the market under a variety of trade names, but only recently has their usefulness in laying dust on the surface of roadways received serious attention.

According to Dr. Benson's report, "the lower half of Sweden has been made practically dustless with sulfite liquor." This liquor was concentrated to form a "lye" containing fifty-two per cent of solid matter, or else it was dried to a powder. To lay the dust, the diluted lye is sprinkled directly over the road, and this surfacing may or may not be followed by the judicious application of either milk of lime or calcium chloride. The powdered lignosulfonate may be spread on the road after a rainfall. The fact that in 1928, over 130,000 kilos of powdered lignosulfonate and 2,000,000 kilos of the lye were used for road improvement in Sweden brings assurance that fewer fish are being poisoned in Scandinavia. Taking a leaf out of the Swedish notebook, the New Jersey Highway Department has used a concentrated waste liquor on the roads of that state with some success during the past few years.

Other uses of waste sulfite can only be touched upon. In fastening linoleum, an excellent cement is now used, in which clay and a preservative are incorporated into the waste liquor. For many years chemists have known that a subtle relationship exists between lignin and the natural tannins. In 1931 nearly 4,000,000 pounds of waste liquor and 280,000 pounds of dry lignosulfonate were used in tanning sole leather in the United States.

Realizing the probable kinship between soil humus and lignin, abortive attempts have been made to use the sulfite waste as a fertilizer, with rather indefinite results. On the other hand the spent liquors have been used successfully in agricultural sprays for combating fungal and insect attacks. Lime and sulfur are already present, and when the malodorous hydrogen sulfide gas is passed into the mixture, a first class imitation of a "lime-sulfur" spray is obtained. The lignin in the mixture plays the role of emulsifying agent. Thus the active combatants, lime and sulfur, are kept in a very fine state of suspension, and can reach the maximum area of leaf and stem with the minimum wase and expenditure.

Some of the "queer" uses suggested for waste sulfite liquor include: its application as a remedy for pulmonary diseases, with a clinic actually opened in Austria forty years ago for the treatment of some sufferers; the preservation of eggs, the prevention of "hoof and mouth disease," the manufacture of explosives, and the "deinking" of old paper. So far no one has suggested it as a cure for the depression. Needless to say, none of these brilliant ideas have solved the problem of lignin utilization.

Photograph by E. S. Harrar.
About one fourth of the dry weight of the Basswood tree is lignin,—that elusive substance which is still one of the greatest chemical by-products of the forest.

The use of lignosulfonate which still merits immediate attention today is that of fuel. Daily wastes from the average fifty-ton pulp mill have a heating value roughly equivalent to that of thirty-three tons of bituminous coal. If this liquor were "desulfurized" and dried by the most efficient methods, the lignin materials would probably furnish enough steam to operate all the pulp digesters of the plant.

What of the lignin in purely agricultural wastes, like straws, corn cobs, and oat hulls? Their study is being vigorously pushed by Dr. Max Phillips and his associates in the Bureau of Chemistry and Soils. Certain cereal plants have the bad habit of refusing to stand up straight when they are nearly full grown. "Lying down on the job" in this way is termed *lodging*. For 135 years agriculturists have debated the cause of this lodging, which frequently brings losses of ten bushels an acre. It has been ascribed, and justly so, to lack of silica and also to the application of too much nitrate of soda fertilizer. Mr. Phillips and his collaborators have shown that if this fertilizer is omitted, the plants contain normal amounts of lignin and stand erect. If, however, it is vigorously applied during the early part of growth, too much lignin is formed and lodging occurs. Until quite recently, it has been generally supposed that lignin functioned largely in fortifying and in lending strength to the plant stem. However, as Drs. Hawley and Dadswell of the United States Forest Products Laboratory had already shown in the case of wood, this is not strictly true. An excess of lignin may make wood brash and brittle. It may also lower the resistance of a cereal plant.

Photograph by E. S. Harrar.

Red Spruce furnishes cellulose to the paper, rayon, and cellophane industries. The dry wood contains over 25% lignin, for which chemists the world over are still trying to find a suitable use.

Much of the work on lignin at the Bureau of Chemistry is still young, but it has interesting industrial implications. For example, when distilled with zinc in hydrogen, lignin furnishes certain very interesting chemicals, among them *guaiacol,* which has been used in medicine, and its near relative, *catechol,* a photographic developer. Direct distillation of lignin gives *eugenol,* important component of cloves and cinnamon. In another type of dstillation, corn cob lignin gave large amounts of an oily distillate. which was carefully separated into eleven components—among them the valued disinfectants *phenol* and *cresol.* A different set of chemical explorations suggest the possible use of lignin in the preparation of "synthetic resins" by its combination with aniline and its coal-tar kinsmen. The use of these artificial products in making varnishes and as binders in the formation of artificial boards may still come to pass, although at present they do not quite measure up to some other synthetic resins.

The investigations at Washington are among the most thorough that have ever been instituted in surveying the chemical possibilities of the lignin of agricultural wastes. They approach far more closely than heretofore the studies made on coal tar.

It seems then that new floodlights are being turned on the lignin mystery, and, that although the lignin molecule still remains shrouded with its economic utilization as yet largely unsolved, progress is accelerating rapidly, and in the right direction. When another commercial bonanza is opened up, when lignin takes its rightful place in industry, due credit should be given to the pioneering spirit of old Anselme Payen, professor at the *Arts et Metiers,* in the gloomy old rue St. Denis.

THE WOODPECKER

The woodpecker pecked out a little round hole
And made him a house in the telephone pole.
One day as I watched he poked out his head,
And he had on a hood and a collar of red.
When the streams of rain pour out of the sky,
And the sparkles of lightning go flashing by,
And the big, big wheels of thunder roll,
He can snuggle back in the telephone pole.

ELIZABETH MADOX ROBERTS.

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"I Saw in Louisiana a Live Oak Growing"

By EDWIN LEWIS STEPHENS

President Southwestern Louisiana Institute

THUS sang Walt Whitman. The tree he saw was standing alone, with moss hanging down from its branches, and it looked so "rude, unbending, and lusty" that it made him think of himself, and of manly love. And what he wondered at most was that the tree standing there was "uttering joyous leaves of dark green," while he frankly confessed that this was something he couldn't do—at least, as he hinted, not without the aid of potent co-operation. He had succeeded in uttering leaves ("Leaves of Grass") that were sufficiently dark and shady, but when it came to standing alone on a river bank with moss on his branches, and uttering dark green joyous leaves, the live oak simply had him bested.

THE LIVE OAK

(Quercus virginiana)

Hail sylvan lord of Louisiana land,
Majestic moss-clad live oak green and gray,
Historian of bayou, gulf and bay,
Along whose banks thy stately shades expand.
Thy beauty, strength, and character command
The grateful homage Man must ever pay
To Nature for the Everlasting Yea
That bids him search and seek to understand.
What span of life along the slumbrous Teche
Hast thou enjoyed, or on fair Avery's Isle
What changes hast thou known, what stress endured?
What legends from thine ancient past conjured
Can all our sense of mystery beguile,
O leafy oracle forever fresh?

I have been considering the live oak for some time, and am coming to believe that the world does not realize what a splendid possession it holds in this tree. In the first place, it got a wrong start in being named *Quercus Virginiana*. Virginia is a fine State,[1] and far be it from me to pluck one laurel from her brow; but I don't believe she has ever had much to show in the way of live oaks. Carolina and Florida, I think, would far surpass her in this respect. In fact, I think this noble tree should have been named for *Louisiana* rather than for any other State. I may be wrong, through lack of sufficient acquaintance with floral geography, but I have traveled in the Gulf coastal region quite extensively in the last few years, and I can confidently report that Louisiana has more and bigger and better live oaks than any other State I have visited. Last year my wife and I counted the live oaks that can be seen on both sides of the *Old Spanish Trail* between Lafayette and New Orleans. We used one of these little rapid-fire gadgets that you count people with as they come through a gate, and we counted 5,230 live oaks in sight of this roadway as you drive the 170 miles between these two well known Louisiana cities. I don't believe this record for live oaks can be equalled in any other stretch of highway in the whole country. And if I am right in this, I think there should be general agreement that this tree would more appropriately be named *Quercus Louisianensis*. It is significant that Walt Whitman coupled the idea of the live oak with the fact of his having seen it in Louisiana—as he did in the poem bearing the title of this article.

But by any other name the live oak would still be just as strong, as stout and sturdy, green and shady; 'illustrious and consummate, noble and sincere'. And my protest is that we don't see or hear enough of appreciation and thanksgiving for this incomparable arboreal gift to man. If any such glorious phenomenon had existed in New England, its renown would have been heralded by all the stars of the New England Illumination. Instead of *The Great Stone Face*, we doubtless should have heard something about

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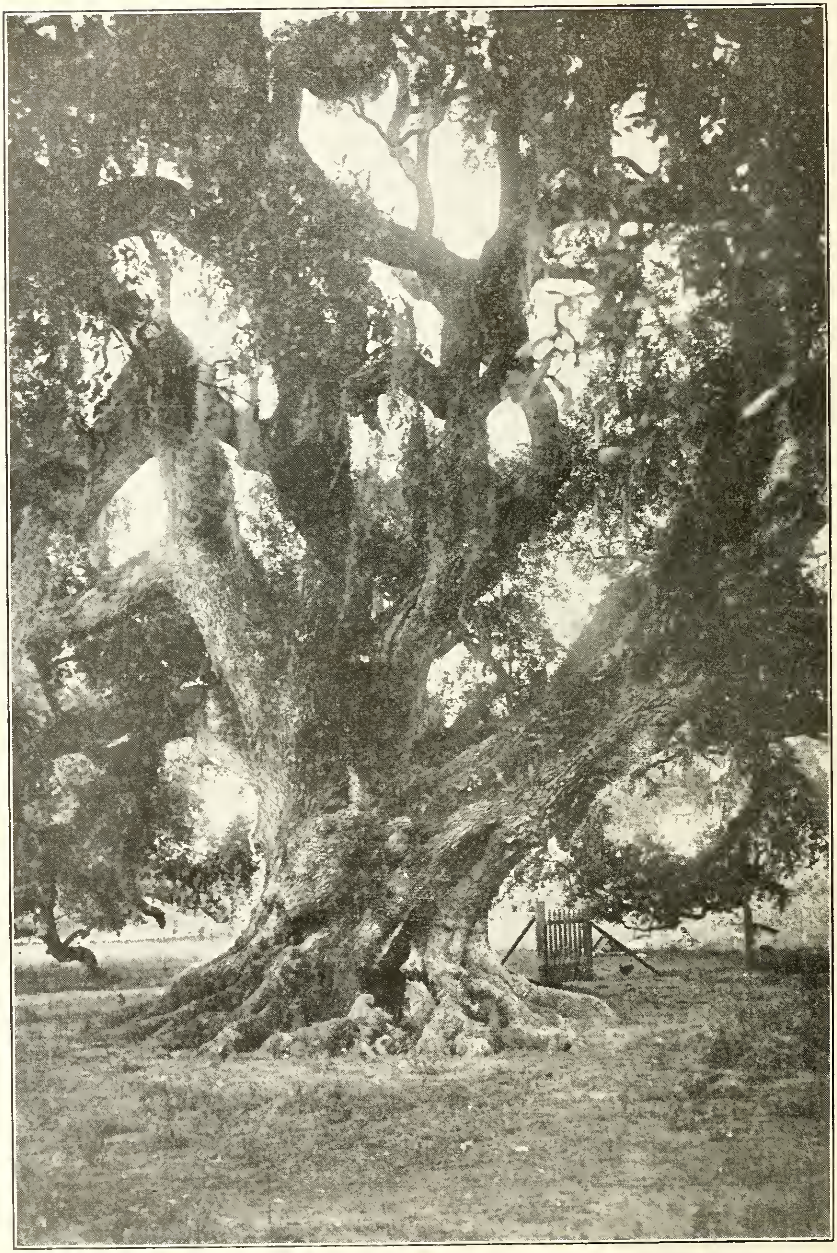
[1] I have just heard by radio the program at Williamsburg, in celebration of the thrilling drama of the magic and dramatic restoration of that royal Colonial city by Mr. J. D. Rockefeller, Jr. and his father. If great live oaks are there, they should be mentioned—for they know the story of Colonial days.



—Photo by Whitesell, N. O.

Vertical Close-up of the Locke Breaux Live Oak

The Great Live Oak. If it had been in Old England, some Keats might well have addressed to the Live Oak such lines as these:

> "When old age shall this generation waste,
> Thou shalt remain, in midst of other woe
> Than ours, a friend to man—".

It is true that our own great Georgian poet, Sidney Lanier, showed his appreciation of the "gospelling glooms of the live oak", "glooms of the live-oaks, beautiful-braided and woven"; and forever identified this tree with the southern landscape, in such poems as "Hymns of the Marshes". In the opening lines of *Sunrise* he says:

> "In my sleep I was fain of their fellowship, fain
> Of the live-oak, the marsh and the main.
> The little green leaves would not let me alone in my sleep".

* * * * *

> "I have waked, I have come, my beloved! I might not abide:
> I have come ere the dawn, O beloved, my live-oaks, to hide
> In your gospelling glooms—".

In *Marshes of Glynn*, he says:

> "O braided dusks of the oak and woven shades of the vine,
> While the riotous noon-day sun of the June-day long did shine
> Ye held me fast in your heart and I held you fast in mine."

But I think it is fair to complain of a general lack of appreciation among ourselves, and to hail the coming of a time when this stalwart figure among God's 'vegetable souls' shall come into worthier recognition; I mean recognition of its aesthetic and ethical, its almost personal, values. To my mind the live oak is the noblest of all our trees, the most to be admired for its beauty, most to be praised for its strength, most to be respected for its majesty, dignity and grandeur, most to be cherished and venerated for its age[2] and character, and most to be loved with gratitude for its beneficence of shade for all the generations of man dwelling within its vicinity.

Why do we not form a Louisiana Live Oak Association? Let its membership be composed of the trees themselves! Such business of publicity as it may require may be carried on with the assistance of friends. I will volunteer my service for a time as Acting Secretary. I suggest that the members of the Association shall consist of trees whose age is not less than a hundred years (thus affording a background of experience, maturity, and wisdom in counsel!). I at present number among my personal acquaintance forty-three such live oaks in Louisiana, eligible to qualify for charter membership. First on the list, and most outstanding timber of the highest rank in the Association, is the *Locke Breaux* Live Oak, on the right bank of the Mississippi River, four miles above Hahnville in St. Charles Parish. It is just across the river from the great Bonnet Carré Spillway, and is located about a hundred yards below the mast of the High Line which crosses the river at that point. This is the largest live oak I ever saw. Its girth four feet above the ground is 35 feet; its height about 75 feet; its spread 166 feet, when I measured it on January 22, 1932, in company with my friend, its owner, the late Samuel Locke Breaux of New Orleans.[3] Mr. Breaux had the tree photographed for me for the cut accompanying this article.

The second 'charter member' to be named would be the *Arnaud Robert* Live Oak, six miles above Breaux Bridge in St. Martin Parish, about a mile west of the Teche. I visited it in company with the late Doctor Albert E. Winship of Boston, September 18, 1932. It then measured 33 feet, 10 inches in girth. Third in order would be the '*George Washington*' Live Oak in Audubon Park, New Orleans, which measured 28 feet, 6 inches around on October 9, 1932. Fourth comes the *Luling* Oak, on the right bank of the Mississippi by the side of the Old Spanish Trail (U. S. 90), a quarter of a mile south of Luling. Its girth was 27 feet, 8 inches, in September 1930. Fifth, the '*Martha Washington*' in Audubon Park, 27 feet, 6 inches. Sixth, the *Mays* Live Oak, on the right bank of Bayou Grosse Tete, on Live Oak Plantation at Rosedale, 27 feet, 6 inches. As seventh, I would place the group known as *"The Seven Sisters"*, on the old Lastrapes place in St. Landry Parish, near Washington. (Washington, d'Ici, not D. C.) One of the seven is dead, but the remaining two clusters of three each measure 27 feet, 3 inches, and 26 feet, 4 inches, respectively. Eighth is the *Jamison* oak on the Preston Pugh Plantation near Thibodeaux in Lafourche Parish, 27 feet, 2 inches; spread, 140 feet. Ninth, the *Kaplan* oak, four miles above the mouth of the Vermilion, near the Intracoastal Canal, 27 feet. 1 inch. Tenth, the big double live oak at *Parks* on the Teche, 27 feet, March 3, 1931. Eleventh, the *Maryland* oak at New Roads—under which James

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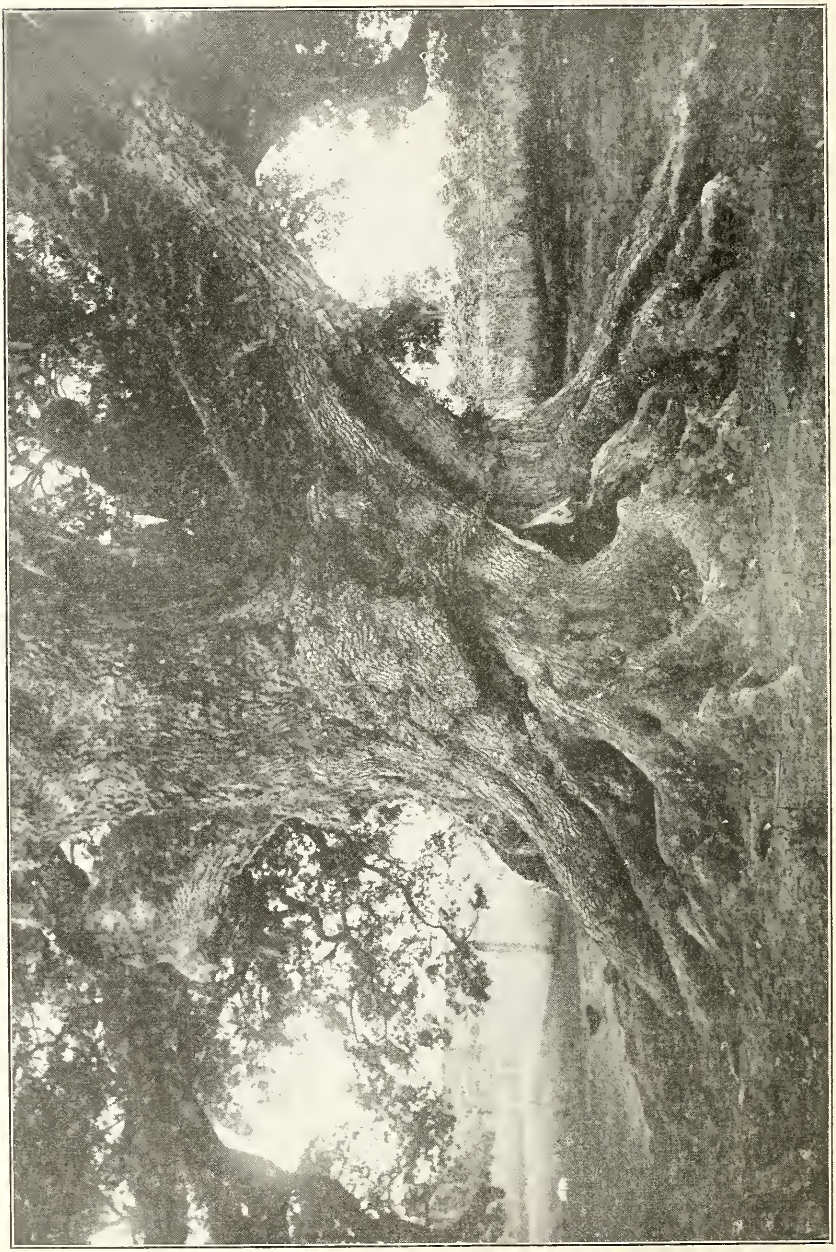
[2] If anyone should interpret the flow of this enthusiasm to ask, "What about *Sequoia gigantea* and *Sequoia sempervirens*", the answer is, "Why bring that up?" That prodigy belongs to a Brobdingnagian category!

[3] Mr. Breaux was a grandson of Samuel Locke of Boston, who came to New Orleans long before the Civil War. Mr. Locke equipped a regiment of infantry for the Confederacy, to be commanded by his son-in-law, the late Gustave Breaux, father of Locke Breaux. The same family includes the English philosopher, John Locke, and my friend Leon Locke, sometime Mayor of Lake Charles; while the Breaux, a numerous Acadian family, include the Breaux and Ballards of Louisville, Kentucky, and Mrs. Daisy Breaux Calhoun, of Washington, D. C.



Close-up of Trunk of the Locke Breaux Live Oak

—Photo by Whitesell, N. O.

Ryder Randall wrote the words of *Maryland, My Maryland,* 24 feet, 3 inches—March 24, 1931. Twelve, the *Potier* oak at Parks, 25 feet. Thirteen, another Audubon Park oak, lower west side, 23 feet, 10 inches. Fourteen, *Breaux Bridge* oak, southwest corner public square, 23 feet, 7 inches. Fifteen, *Bayou Grosse Tete,* left bank, near Central Plantation, 22 feet, 6 inches. Sixteen, the *Stonaker* oak, on right bank of the Mississippi, near New Roads, 22 feet, 2 inches, August 13, 1930.[4] Seventeen, *Kenner Ferry* oak on the Mississippi, west bank, 22 feet, 2 inches, February 1, 1931. Eighteen, *Jefferson Island* oak, near front entrance, 22 feet, 2 inches (largest on the Island), April 24, 1931. Nineteen, the *Cleveland* oak on Avery Island—so called because admired by President Cleveland on a visit (largest on the Island), 22 feet, March 5, 1931. Twenty, the great *McDonogh* oak in City Park, New Orleans, 21 feet, 8 inches. Twenty-one, another on Avery Island, 21 feet, 7 inches. Twenty-two, the *Gosserand* oak on False River, 21 feet, 5 inches. Twenty-three, another on Avery Island, 21 feet, 3 inches. Twenty-four, *New Iberia* oak on public school grounds, Main Street, near residence of Walter J. Burke, 21 feet. Twenty-five, another at Parks, 20 feet, 7 inches, January 3, 1931. Twenty-six, *Campbell* oak, Catholic Cemetery, Lafayette, near the grave of Judge William Campbell, 20 feet, 6 inches, April 20, 1931. Twenty-seven, *Charenton,* Shell Beach (largest of several), 20 feet, 4 inches. Twenty-eight, *Rochard* oak, Breaux Bridge, garden of Père Rochard, 19 feet, 11 inches, April 30, 1931. Twenty-nine, *Grenier* oak on the Lafourche, four miles above Thibodaux, right bank, 19 feet, 10 inches. Thirty, *Rosedale* oak, east bank of Grosse Tete (largest of a group of ten), 19 feet, 6 inches. Thirty-one, another in Audubon Park, New Orleans; centrally located, 19 feet, 5 inches. Thirty-two, *Monarch of Paradise Woods,* Breaux Bridge (the largest tree in this incomparable grove), 19 feet, 2 inches, November 20, 1929.[5] Thirty-three, *Cathedral* oak, Lafayette, 19 feet (measured for State Superintendent Francis G. Blair, of Illinois, who published some account of it in his annual Arbor and Bird Days book for 1929). Thirty-four, *Singleton* oak on Twin Oaks place, five miles northeast of Carencro, 18 feet, 3 inches. Thirty-five, *G. A. Martin* oak near Lafayette, 18 feet, 3 inches. Spread, 150 feet; height, 75 feet, February 21, 1931. Thirty-six, another Audubon Park oak, 18 feet, 3 inches. Thirty-seven, *Broussard* oak, near depot, Broussard, La., 18 feet. Thirty-eight, *Thomas D. Boyd* oak (larger of the two great live oaks that were in front of the President's Residence on the Old University Campus—now in front of the new State Capitol), 18 feet. Thirty-nine, "*Uncle George*" oak, near Mobile, Alabama,[6] west end of city on Old Spanish Trail (U. S. 90); now a charred trunk, 17 feet, 3 inches. Forty, *Protestant Cemetery* oak, Lafayette, 17 feet, 6 inches, September 6, 1930. Forty-one, *Shady Grove* oak in Iberville Parish, 17 feet, 3 inches. Forty-two, *St. Denis* live oak in American Graveyard, Natchitoches, 17 feet, 2 inches, January 27, 1931.[7] Forty-three, the *Gebert* oak, New Iberia (beautiful show tree, in middle of walk at Gebert residence on main street. Set out in 1831); 17 feet.

All these live oaks are certainly more than a hundred years old. Their trunks don't get to be 17 feet in circumference in less than that time, so far as I have been able to learn. It is doubtless true that many live oaks of much smaller girth are more than a hundred years old. The size of the trunk varies much according to whether the tree grew up in the open, far from competition with other growth, or whether it chanced to be "close-grown", that is, crowded in among other trees, under natural forest conditions. Cross-sections illustrating open and close growth of pine trees were shown among exhibits at the meeting of the American Association for the Advancement of Science in New Orleans two years ago. The difference was very marked. Therefore we may infer that close-grown live oaks may be several hundred years old, and still much smaller in girth than these we have listed. So there should be a by-law for this Live Oak Association, admitting members of smaller girth than 17 feet, when sufficient evidence appears for the age of not less than a hundred years.

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[4] This is the oak so beautifully photographed in an article in the Louisiana edition (April, 1930) of the *Geographic,* and apparently indicated as being in St. Francisville. I owe apologies to the author of this article, Mr. Ralph A. Graves, for mis-quoting his legend under the picture of that tree. In my article on "*How Old Are the Live Oaks*", in *American Forests,* December, 1931, I quoted from a complex of hearsay, and incorrectly represented him as saying that the tree was on the grounds of the high school at St. Francisville.

[5] This grove of 83 live oaks on a 20-acre tract on the right bank of the Teche just west of Breaux Bridge in St. Martin Parish may be the most remarkable group of its kind in the world. Doctor Ellsworth Woodward, Professor Emeritus of Art in Newcomb College, Tulane University, says it surpasses in size and beauty any he has seen in his travels over the world. Professor Woodward has painted the tree referred to above for the Delgado Museum, New Orleans. This tract should be purchased and maintained as a public park.

[6] By special courtesy invited to be a charter member of the Louisiana organization. It was said to be the largest live oak near Mobile. Right across the street another good sized live oak is growing right through the roof of a place called the "Roof Tree Inn", where they make the best waffles we have tasted in seventeen states.

[7] This tree is undoubtedly the oldest living thing in Natchitoches, the oldest town in Louisiana, and is appropriately associated with the name of *St. Denis,* the French officer who made this colonial settlement for France on the nucleus of an old Indian village.

If there is no objection, then, the Louisiana Live Oak Association, composed of venerable trees of the age of more than a century, with the foregoing list of 42 as charter members, is hereby ordained and established. The Chair hears none; it is so ordered! Let the annual dues be 25 acorns from each member, to be sent to the Secretary on or before January 1, to be planted on Southwestern Institute farm near Lafayette.

Friends of the live oak everywhere are invited to communicate with the Acting Secretary, giving location and measurements of great live oaks in their vicinity for membership in the Louisiana organization, or in similar organizations that may arise in other states. Take the girth of the tree with a tape line, at a height of four feet from the ground. Also measure the diameter of the spread, from tip to tip of the longest limbs, and estimate the height. Trees younger than a hundred years may be noted and listed for a later organization of the Junior League! It is particularly desired to know whether any live oak tree anywhere is larger in girth of the trunk than our Number One Charter Member, the *Locke Breaux* tree we have described.

Friends of the organization are also requested to send to the Acting Secretary contributions to a bibliography for the Live Oak Association; including the titles of all books and magazine articles concerning the live oak, all quotations from literature, both prose and poetry, referring to it, and all historical data associated with distinguished specimens of this tree, wherever located. Libraries in this region are requested to specialize on the live oak, their principal tree. And a public conscience should be developed throughout the Gulf coastal states, promoting a wider appreciation of their live oaks. Public walks and highways should be detoured around a venerable live oak, making it even more conspicuous; and no live oak tree should ever be destroyed, except upon a verdict of a jury of its peers (!), duly confirmed after an appeal to the Supreme Court of public opinion, after refusal of rehearing and all legal delays. The Association will doubtless appoint committees to promote legislation providing for such live oak conservation.

In conclusion let me make acknowledgments to the dear old Autocrat of the Breakfast Table, who used to go about Cambridge measuring elm trees. I learned that habit from him, and am indebted to him for the development of an abiding interest in arboreal life.

The Acting Secretary begs leave on page 1 of the Minutes the humble attempt at a sonnet reproduced on title page of this article.

WHAT DOES LITTLE BIRDIE SAY?

What does little birdie say,
In her house at peep of day?
"Let me fly," says little birdie,
"Mother, let me fly away."

"Birdie, rest a little longer,
The Daffodils blowing,
Till the little wings are stronger,"
So she rests a little longer,
Then she flies away.

ALFRED TENNYSON.

FLOOD OF REFINED SUGAR

(Continued from Page 1)

the consumption of 21 States. How much this represents in loss of work and loss of income thriughout the country can be estimated from the fact that 19 refineries paid out between 1922 and 1931 in wages and salaries $231,605,137. They pay out for materials and supplies, including coal, oil and power, approximately one billion dollars in a normal ten-year period, furnishing business for many industries and employment for many thousands of our people.

"Continental United States refineries operate under N. R. A. and A. A. A. programs, paying the new processing and manufacturing taxes on supplies. Refined sugar from outside is produced under tropical conditions and Cuba is not subject to N. R. A. or A. A. A. programs.

"Today several United States cane refineries are closed entirely and all others are working on part-time, *although the country eats as much sugar as usual. Every pound of refined sugar was paid for by Continental United States families but no Continental United States workman got a dollar for refining! On the contrary, every pound imported means unemployment in ever-widening circles!* Tropical refineries hum; United States refineries work part-time.

A small group of outside producers now demand that a quota for refined sugar be established to make the unfair position it has secured in the last few years a permanent one—permanently displacing workers in the Continental United States, permanently closing United States refineries. The remedy lies with Congress.

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MILESTONES OF PROGRESS IN THE REALM OF SUGAR

By
ROBERT GLENK, Ph. M.
Curator, Louisiana State Museum

THE home of the sugar cane, as of many other of our cultivated plants, is India. It seems to have thrived there from time immemorial according to Sanskrit writings. The first historical account of the culture of sugar cane reached Europe through the Greek soldiers of Alexander the Great, who found the cane growing in India at the time of their conquest of Asia in 327 B. C.

From India the sugar cane was carried Eastward and Westward. It was introduced by the natives through the islands of the East Indies, the Philippines, Samoa, Tahiti, and the other islands of the southern Pacific, and from there it was transported by daring native navigators to the Hawaiian Islands, where it was found growing by Capt. Cook at the time of his voyage of discovery. The Pacific Islanders, however, cultivated the sugar cane simply for the purpose of chewing its stalk or drinking its juice; none of them ever advanced so far as to make sugar.

The western nations must receive the credit for the development of this art.

As far back as 300 B. C., the medical writer, Paul of AEgina, told of the "Indian salt, which in color and form is like common salt, but in taste like the sweetness of honey."

The first to transport the sugar cane westward were the Persians. They not only grew cane for chewing, or for its juice, but also made some progress in sugar making. Traces of Persian influence survive to the present day in our word "candy", which is derived from the Persian *"kand"*, meaning hard or loaf sugar. For raw sugar the Persians had a diferent word, *schaker*, the same as our word sugar, a word very much alike in all languages, and derived from the original Indian or Sanskrit word *sakkara*.

It was the Arabs, however, who brought about the introduction of the sugar cane to the nations of Europe. The familiarity of Arabian Caliphs with agriculture, the sciences, and the useful arts fostered the civilization of the ancient East and transmitted it to Europe. The Mohammedans, in their conquests of Persia and India, learned how to grow the sugar cane and they transplanted it to the nations of the west. Improvements in cultivation and irrigation were introduced, and the experience of Arabian alchemists and physicians with the process of recrystallizing salts led them, no doubt, to apply the same principle in refining sugar. In the books of the great Arabian scientist Avicenna, who lived about the year 1000 of our era, we find sugar described as we now know it. From this time onward the use of sugar was destined to increase, until from one of the rarest and most expensive articles of luxury it became one of the cheapest and most abundant food products of our day. From the Valley of the Tigris and Euphrates, the Arabs carried the sugar cane into Egypt and Palestine and, with the extension of their conquests westward, transported its culture into Asia Minor, North Africa, to the Mediterranean islands of Cyprus, Rhodes, Crete, Malta, and Sicily, and finally to the continent of Europe itself. It is still widely cultivated in southern Spain.

Another agency which favored the introduction of sugar to Europe was the Crusades. The crusaders found the sugar cane growing in Palestine, and, like the soldiers of Alexander 1500 years before, came back with stories of the wonderful reed whose sweet juice invigorated them after a weary conflict or march.

The Portuguese transplanted the cane from Sicily to Madeira, and in 1450 it began to be cultivated in the Canaries, Azores, and other North Atlantic islands.

Immediately after the discovery of America followed the transplanting of sugar cane to the western hemisphere. Columbus on his second voyage, in 1493, carried with him sugar cane from the Canaries to Hispaniola, now known as San Domingo.

In 1518 there were already 28 sugar plantations on the island and from here cane culture spread rapidly over Mexico, Martinique, Guadaloupe, Cuba and South America as early as 1650. The method of extracting the juice was quite primitive.

The type of mill employed in these early sugar cane factories was of the vertical stone edge runner type, such as is used at the present time in the Mediterranean countries for crushing olives. This form of mill was also used in Spain for crushing cane and was introduced into the American colonies at the beginning of the industry.

Old illustrations of sugar making as it was carried on in Brazil about 1630, show in detail the processes of manufacture. The stalks of cane being brought in from the fields in oxcarts, then chopped into small pieces and carried in baskets to a hopper where they passed to a crusher driven by oxen or the water wheel.

The crushed cane was squeezed in a screw press operated by man power and the cane juice collected in a vat. This juice was then evaporated in a series of large kettles over the open fire, the skimmings set aside for fermentation into rum, and the thick crystalline mass ladeled into conical molds or hogsheads.

The raw sugar made by these early methods varied greatly in quality, due to imperfect clarification of the juice. Wood ashes was one of the earliest and most available materials for eliminating impurities and milk was also used when available.

With experience it was found that lime was a better and cheaper agent, and hydrated lime, used in Egypt as early as 700 A. D., is still the substance most universally employed. The evaporation of the cane juice was performed in open kettles over direct fire, a method which is always attended by darkening of the sugar.

Elimination of the molasses from the crystals of sugar was not attempted in the early processes of manufacture. The juice was simply evaporated to a semi-solid consistency, and this mass of crystals poured into hogsheads having openings at the bottom for the drainage of the molasses. The residue of sugar in the cask, as made by this process, was termed *muscovado* sugar.

In some raw sugar factories, the semi-liquid mass of sugar crystals, or *masse cuite*, was poured into a conical mold having an opening at the point for the escape of molasses. The loaves of sugar thus made varied in color from yellow to nearly black. Sometimes the loaves of raw sugar were whitened by packing them in wet clay. The clay absorbed the molasses by capillarity and left the loaf of sugar much whiter.

Most of the raw sugar made in Arabia during the 14th Century was sent to Europe for refining, the Venetians having a monopoly of the refining business. Later this branch of sugar manufacture passed into the hands of the Dutch.

England received its first shipment of sugar from Venice in 1319.

When it was first made and up to within the last century, sugar was not regarded as a food, but as a medicine available only to the rich.

In the year 1353 King John II of France issued an ordinance forbidding the apothecaries of Paris from substituting honey for sugar. Evidently, in those days, sugar was a more expensive drug than honey.

As late as the 17th century, Doctor Salar writes of its medicinal virtues: "Sugar, used in a proper manner, nourishes the body, generates good blood, cherishes the spirits, and makes people prolific. It is serviceable in complaints of the throat and lungs, chest, kidney and bladder. It eases pain of the intestines, it

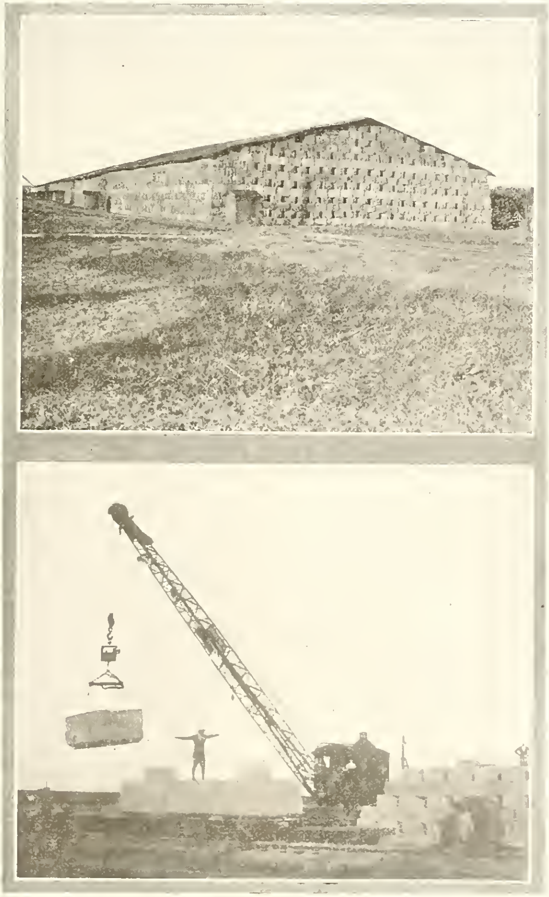
(Top) Cutting Sugar Cane in One of Louisiana's Large Cane Fields.
(Bottom) Transporting Sugar Cane from Field to Mill.

cleanses wounds and punctures in the body, it removes pains and ulcers and tumors by concocting a flux of humors," all of which sounds very much like the claims of a modern patent medicine. His praise was not universally accepted, however, for we find a contemporary of his, Theophilus Jancieres, in 1647, saying that: "Sugar and all kinds of sweetmeats are very hurtful in consumption of the lungs, and as I conceive it, the too frequent use of these things tends to create that disease." Also an English physician, named Ray, in 1688 says: "In regard to the scurvy, some more modern physicians, as well as those of ancient times, agree that it is produced by the great use of sugar, and that the latter is very hurtful to the teeth and not only renders them black but causes them to decay and to loosen in their sockets, which are certain signs and symptoms of scurvy." Martin, the English author, writes: "Everywhere the beasts of the field, reptiles, fish and insects, are fond of sugar and honey. The most savage and vicious horses have been tamed by sugar and it is to the judicious use of sugar that tamers of lions and tigers chiefly owe their power over them.

"In Cochin-China, the elephants, buffaloes and horses are fattened with sugar and molasses."

Just when sugar began to be used as a foodstuff is uncertain. In 1700, the price of refined sugar in London was 2½ shillings per pound, while in 1800, it was still 1½ shillings and correspondingly high in other parts of Europe.

Louisiana comes into the record in 1725-26 when the cultivation of cane is first mentioned. On his return in 1733, Bienville found that the colonists had already taken up its cultivation for the production of tafia. The Jesuits of San Domingo sent a shipment of sugar cane and skilled negro planters to New Orleans for the purpose of establishing an industry in the new colony in 1751, but the cane did not mature well and all attempts to make sugar resulted in failure. The variety introduced is known as the "Malabar" cane. In 1758, a planter named Dubreuil made large scale experiments and erected the first sugar factory in Louisiana. He turned out a kind of Muscovado sugar and rum.



(Top) Enormous Stock of Bagasse, the Refuse of Ground Sugar Cane, in Storage for Future Use in Manufacturing of Celotex. This Splendid Building Material Is Manufactured in New Orleans.
(Bottom) Loading Some of the Same Material.

The Chevalier de Mazan, living on the right bank of the river near the city, also undertook to manufacture sugar in 1764, but failed. Again, in 1765, several planters, among them Destrehan, then treasurer of the King of France in the colony, put up works similar to those of Dubreuil, below the city on the left bank of the river. The small quantity of sugar made by them and consumed in the country "looked like marmalade" and was of poor quality.

Up to this time, neither the use of lime for clarification nor the proper point of concentration for striking were known — two essential factors for successful sugar manufacture.

These failures, together with the

transfer of the colony at this time by France to Spain, and doubtless other causes, checked further efforts at making sugar, but many farmers continued to grow the canes for chewing to supply the markets of the city and to manufacture "tafia". A large acreage of cane was grown for the manufacture of rum called tafia, and Governor D'Abbadie in 1764, in his official report to his government, speaking of the immoralities of the people, said that: "The immoderate use of tafia stupefied the whole population."

In 1791, Antonio Mendez, of New Orleans, bought a standing field of cane together with a distilling outfit, firmly resolved to devote himself to sugar and rum manufacture. To this end, Mendez employed Morin, who came from San Domingo and knew the method of cane culture and sugar making. But whether it was that Mendez did not have an adequate sugar factory like those of San Domingo or whether the cane crop was inferior, but few barrels of sugar were made. He experimented also in refining sugar, for in 1792, Mendez presented Don Rendon, Intendant of Louisiana for Spain, some small loaves of sugar refined by him.

At a dinner given that year to the authorities of the city of New Orleans, Intendant Rendon called attention of his guests to this sugar describing it as a Louisiana product made by Antonio Mendez.

The claim that Mendez made the first sugar in Louisiana and was also the first to refine it is substantiated, but evidence is wanting that he made it in paying quantity.

The first crop of sugar large enough to influence the future of Louisiana was made by Etienne De Bore, son-in-law of Destrehan, in 1794-95-96, near the site of the sugar Experiment Station at Audubon Park, New Orleans. Gayarre, the historian and grandson of De Bore tells of the excitement prevailing in the community and the intense interest manifested by the planters in the outcome of this bold adventure. A large crowd waited with eager impatience the concentrating of the juice to the granulating point, and stood with breathless silence to catch the first announcement that "it granulates."

This first crop of sugar sold for $12,000.

De Bore was overwhelmed with congratulations, and was called the "Savior of Louisiana." His successful results stimulated scores of planters to follow his example, and sugar plantations with primitive sugar factories were rapidly established with each succeeding year.

In 1802, the cane products marketed in New Orleans amounted to five million pounds of sugar, 250,000 gallons of molasses and 200,000 gallons of rum.

How profitable the industry was at the time of the Cession of Louisiana we learn from a letter written by Governor Claiborne to President Jefferson in which he states: "The facility with which sugar planters amass wealth is almost incredible. It is not uncommon with 200 working hands to make from 10 to 14 thousand dollars and several planters with only 40 field negroes made $20,000 a year."

It took fully 300 years from the time of the introduction of sugar cane into the West Indies before the sugar industry became remunerative in the New World.

The birth of the modern sugar industry may be said to date from 1806, when Napoleon announced his blockade of the continent of Europe against England. While his famous edict did not accomplish its main purpose, its effects were influential in other ways, for it stimulated manufacturing and the arts to an unprecedented degree. In order to relieve the craving of the people for sugar, strenuous efforts were made to provide a substitute. In some parts of Europe, maple sugar was manufactured, but insufficient in quantity to supply the demands. The famous chemist, Proust, devised a process for obtaining the crystallizable sugar, dextrose, from grape juice. A German chemist, Kirchhof, invented a process at this time for manufacturing dextrose from starch, and efforts were begun to establish a new starch-sugar industry. Dextrose, however, lacked the sweetness of sucrose, and the consumers of sugar refused to content themselves with such a substitute.

Maargraff, also a German chemist, in 1747, discovered that the sweet principle in the garden beet was a sugar corresponding in all its properties when clarified to the sugar of commerce, and prepared laboratory specimens of it. One of his pupils, Achard, was the first chemist to prepare sugar on a large scale from the beet and the results of his efforts were announced in 1797. At this time beet roots contained a little over 6 per cent of sugar and Achard announced that it would be possible to prepare sugar from this source at a cost of not to exceed 6 cents a pound. By reason of the continental blockade, due to the Napoleonic wars, this discovery of Achard excited in France the liveliest interest and a commission of the French Academy of Sciences was appointed to investigate the matter.

In 1800, an experimental factory was started, but the new industry did not prosper at first and ten years elapsed before adequate improvements were made which guaranteed success. Just at this time the markets of Europe were again opened to the supplies of tropical cane sugar by the defeat of Napoleon and the abolition of the blockade and it seemed for a long time as if the new beet sugar could not compete with cane sugar, the cheaper product of tropical slave labor.

French statesmen, however, were far-sighted enough to protect the new industry with bounties and tariff regulations, so that the manufacture of beet sugar increased. The financial difficulties which the industry encountered, stimulated greater improvements and economies both in agriculture and in sugar making. This policy, eventually, placed the beet-sugar industry far ahead of its rival.

Neither Maargraff, Achard or Napoleon in their wildest dreams of success could have had any conception of the enormous production of beet sugar which in our time became an accomplished fact, and which in their time was but a scientific curiosity.

The cane-sugar industry, temporarily handicapped by the abolition of slavery, was in its turn forced to make improvements, and this was done by adopting the newer inventions and discoveries that had been worked out in beet-sugar making. It will be enlightening to mention some of the most important improvements which have been made in sugar manufacture since the foundation of the beet-sugar industry.

The introduction of the steam engine as a propelling power of the sugar mill by John J. Coiron, in 1822, marks the beginning of a new epoch in the sugar industry in Louisiana, even though delayed for several years by the extravagant price of the imported mills and engines. When foundries in this country began their manufacture, prices fell within the reach of the less wealthy planters, so that in 1828, there were eighty-two sugar estates using steam power. From that time steam boilers and engines have entirely supplanted horse power in Louisiana.

Coal was first used as a fuel in the sugar house in 1840, and bagasse burners also were invented about this time.

In the year 1845, seventy-two steam engines and mills were installed in Louisiana factories, coming from Pittsburgh, Cincinnati, Louisville, New York, Philadelphia, and Richmond.

The vacuum pan, invented by the English refiner Howard in 1813, was introduced by T. A. Morgan into his Orange Grove plantation below New Orleans in 1830 and its installation created almost as much interest among planters as De Bore's experiments did in 1795.

Soon after, Valcour Aime, of St. James, and Gordon and Forstall, also imported and erected Howard's vacuum pan, and these primitive refineries are said to have produced a good grade of refined sugar. The efficiency of the vacuum pan for boiling sugar solutions at a lower temperature due to reduced atmospheric pressure, was considerably enhanced by the invention of the condensing column by Davis in 1829, which condensed the vapors from the vacuum pan and produced a high degree of vacuum.

Another great invention, of about that time, was the multiple effect apparatus devised by a native of New Orleans, Norbert Rillieux. He conceived the idea of evaporating sugar juice, not in one but in several vessels, and of so connecting these that the hot steam from the evaporating solution in the first effect boiled the solution in the second, and the steam from the second effect boiled the solution in the third, and so on. By increasing the vacuum in the effects as the heating power of the steam diminished, it was found possible to boil off water in a number of vessels by the heat which was supplied to the first unit of the series. The original evaporation of Rillieux was a triple effect built horizontally like a locomotive boiler.

Its introduction into Louisiana, where his apparatus was first tried, brought about a complete revolution in sugar boiling. The first installation was made on the Packwood Plantation, at Myrtle Grove, and was a great success from the start.

The Polariscope was invented in 1835 by the great French physicist Biot. This apparatus made it possible to determine the sugar content quickly and accurately and has done much to advance the making of sugar and the control of manufacturing operations in the sugar house. By the old method of "purging" it took months to eliminate the molasses from the evaporated sugar juices or "masses cuites."

The invention of the centrifugal machine in 1844 by Schottler, shortened this time to a few minutes.

In 1849, Melson's patent on the use of bisulphite of lime for bleaching cane juice was taken out and adopted by many Louisiana sugar makers with good success.

The filter press, too, invented in 1853, by Needham, facilitated the filtering off of the impurities of the clarified juice with cleanliness and dispatch.

So within a period of 20 years, the invention of the multiple effect evaporation, the filter press, the centrifugal and the polariscope, greatly stimulated the manufacture of sugar by lessening the cost of production, and speeding up the various processes of the sugar house.

One great improvement initiated by the cane industry, was the construction of more effective mills for the extraction of the juice from the cane.

The Cora plantation was the first to erect a nine roller cane mill in 1880.

Another appliance which stands in intimate relationship with the betterment of the cane mill is the improved bagasse burner in which the bagasse, transported by carriers directly from the mills to the boilers, is burned by a forced draft from blowers, producing perfect combustion and without previous drying.

The Crystallizer, a contrivance in which the thick mixtures of sugar and molasses are slowly rotated while cooling, thus promoting the rapid crystallization of the sugar dissolved in the molasses, and perfected in 1884 by Wulff, is also worthy of noting as a step forward in sugar house practice. In fact, so many fuel and labor saving devices were originated in the latter part of the 19th century, that it is difficult to determine their priority.

But the great impetus to the sugar industry came about not only by the introduction of improved machinery, but in a large part by the accurate chemical control or supervision of the various stages of manufacture to insure maximum result. In this way it was possible to determine the amount of sugar entering the factory in the cane and the percentage of marketable sugar obtained as a final product and also to control the quality of the raw or refined sugar as to polarization, and other factors affecting the price or keeping qualities of the product.

"Eternal vigilance is the price of safety," and of profits and there is no let up of this chemical supervision from the time the campaign begins until it is finished. The moment a wrong turn occurs at any stage of the process the fact is quickly noted and losses stopped in all modern sugar factories.

While the cultivation of sugar cane may have been very profitable at the beginning of the 19th Century in Louisiana, Judah P. Benjamin writing in DeBow's Review in 1846, makes the following observation, "To a person accustomed to regard the bountiful returns which nature yields to man's labor in the cultivation of other crops, no fact strikes with more surprize than the small comparative return obtained from the cane. The seed seldom yields more than four fold, hardly ever more than five fold. The very smallest quantity of cane required for planting 100 acres, is 20 acres of the finest cane and if, as too frequently is practised, the smallest and poorest cane is saved for planting, it is necessary to put up, 30, 40 even 50 acres in cane in order to plant one hundred acres." This statement would seem to indicate that the sugar planters already had their troubles in 1846.

The agricultural side of the sugar industry was unfortunately not given the scientific attention that it merited, for it must be clearly kept in mind that sugar is made in the field and not in the factory.

The chemical processes taking place where the cane is growing were too much neglected. Summing up the factors entering into the cost of sugar making, we find that three quarters of the expense is due to the agricultural operations of planting, cultivating and harvesting and only one quarter to its extraction in the factory.

Logically, the agricultural side of sugar making deserves the greater part of the attention bestowed by scientific investigations, and studies to determine the most advantageous types of canes as regards resistance to disease and insect pests, quick maturity, high sucrose and purity of the juice will be necessary to the future stability of the cane sugar industry. A great part of the success of the beet sugar industry is due to the care given to chemical selection of beets for seed and other agricultural matters.

The introduction of the striped and purple varieties of cane by John J. Coiron in 1817 and 1825, was of particular importance and they soon supplanted the malabar and all other varieties of canes in Louisiana. Later, in 1872, these varieties were supplemented by the white Java cane introduced by B. M. LaPice and successfully grown for a long time.

In 1886, Dr. W. C. Stubbs, Director of the Louisiana sugar experiment station, through the cooperation of Secretary Coleman secured a large collection of seedling canes, two of which the D74 and D95 proved to be of unusual promise and eventually replaced the other varieties to a large extent in the agriculture of Louisiana. With the introduction of the Mosaic disease, all the varieties of canes hitherto grown for the manufacture of sugar had to be replaced by other types of seedling canes developed in Java and Florida and reasonably proof against the disease. Experiments conducted in Louisiana and elsewhere have since resulted in the development of still more advantageous types of canes in regard to resistance to disease and insect pests, time of maturity, sucrose content, purity of juice and adverse climatic conditions.

Another factor vitally influencing the prosperity of the sugar industry from its very beginning has been the tariff. The first duty imposed upon sugar was in the nature of tariff for revenue only, the rate being 2½ cents per pound and this rate continued in force from 1789 to 1832.

From that date up to 1842, a compromise act was in force, under which, with gradually decreasing tariff and greatly increasing sugar production in Louisiana and in Cuba, a situation was created which resulted in ruinously low prices of sugar.

The tariff of 1842 created a new era for the Louisiana sugar industry by restoring the old rate of 2½ cents per pound. Until 1831, it was the belief that Louisiana sugars were too weak for refining and our Edward Livingston confessed that this was actually so when testifying before Congress in 1840.

Eastern politicians seized upon this admission to demand an abolition of duty on sugars imported for refining on the plea that no protection should be asked by Louisiana against an article which the state could not produce. If it had prevailed, this would have been a fatal blow to Louisiana.

At this stage of the controversy, Gordon and Forstall introduced the vacuum pan process into the Louisiana sugar factory and the arguments of the politicians of the East were met by several hundred tons of pure refined sugar which brought a high price in New York in 1840. For a time, this demonstration put an end to arguments for the free importation of sugar.

Since the foundation of the United States government, sugar has been on the free list but once, and that during the bounty period of 1890-93. It was lowest (three quarters of a cent a pound) at the opening of the Civil War, and the highest in 1812-16, during the second war with England. While the tax on sugar fluctuated greatly, this important source of revenue was never entirely neglected, save for a short time in the nineties.

The most important agency at work in behalf of the advancement of the sugar industry was the organization called the Louisiana Sugar Planters Association, begun in 1877. The leading planters became members of the Association under the leadership of the distinguished Duncan F. Kenner.

As an outgrowth of the activities of the Association, was the establishment of the Sugar Experiment Station in 1885 and the appointment of Dr. William C. Stubbs as first director. It was originally domiciled at Kenner and later was moved to the Audubon Park site where its experiments upon the growing of cane and sugar making were conducted very successfully for a period of 38 years.

The Audubon sugar school also owes its beginning to the activities of the Louisiana Sugar Planters Association. This school was established in 1891 in connection with the Sugar Experimest Station and also under the direction of Dr. W. C. Stubbs.

The object of these agencies was to organize research in the agriculture and technology of the cane sugar industry and to train experts for positions of responsibility in the sugar factories and plantations of Louisiana and the tropics.

While the Sugar Experiment Station continued to function at New Orleans until 1923, the Audubon Sugar School was transferred to Baton Rouge in 1899, where it became a department of the Louisiana State University and was ably conducted by Dr. Charles E. Coates, as the dean, until the present time.

For a number of years the Sugar Experiment Station was used for practical instruction of the students of the sugar school in the field operations and factory management.

The Sugar Growers' Association was formed in 1897 for the purpose of securing proper protection to the sugar industry at the hands of Congress and the membership included nearly every planter in the state. Charles A. Farwell was the first president.

This Association is now superseded by the American Sugar Cane League domiciled in New Orleans and of which R. H. Chadwick is president and Reginald A. Dykers business manager and editor of the Sugar Bulletin, the weekly journal of the association.

These organizations were all devoted to the upbuilding of the sugar industry and have done their part well. What the future of the Louisiana Sugar Industry will be is now in the lap of the Gods.

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Marking Fish*

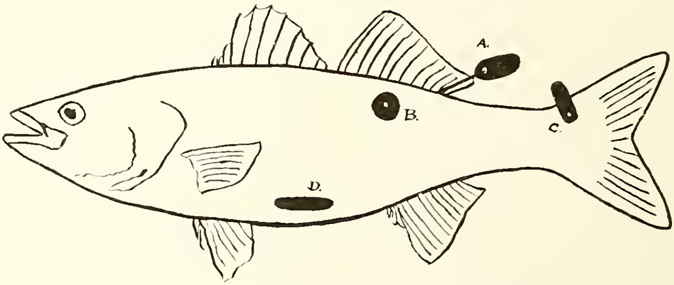
By

JOHN C. PEARSON

Assistant Aquatic Biologist, U. S. Bureau of Fisheries

MOST conservationists and others interested in our wild life have been familiar for many years with the efforts of bird students to band wild birds to determine routes of migration. Migrations of fishes have not generally provided as widespread a popular interest as those of birds and, consequently, the experiments by scientists to mark or tag fishes are relatively unknown to the layman.

The only positive way to trace the movements of individual wild fish is through tagging, marking, or placing upon the fish some mark of identification which will remain legible over an extensive period of time, which will be easy of recognition to those who chance to catch the fish, and which will be capable of bearing essential information such as a serial tracing number and the address to which the tag or fish is to be returned. The primary purpose of this marking of wild fish has been to determine possible movements or migrations and the important secondary considerations involve the gathering of information on the rate of growth of the fish, and on the intensity of fishing effort expended by anglers and commercial fishermen in the capture of various food and game fishes.



SKETCH ILLUSTRATING THE PRINCIPAL TYPES OF FISH TAGS

A is the Atkins tag, the first type used in fish marking. B is the disk or button tag, the most widely used at the present time. C is the metal strap tag, used largely on Alaska salmon and codfish. D is the internal tag, the latest development in fish marks. Types B, C, and D comprise the only varieties of fish marks now used within the United States. Variations in the structure and place of attachment of these marks have been made by many investigators.

Marking fish is an old practice. Isaac Walton in "The Compleat Angler," written in 1653, mentions having heard that before his time fish were marked by tying ribbons around their tails. This early fish marking was probably done more in a spirit of amusement than scientific research. In the spring of 1852, an Englishman, Alexander Russel, mentions that 500 young salmon along the coast of England were marked by means of plain silver wire. Only three of these marked fish were ever recovered. One of these three was found in the stomach of a codfish, with nothing remaining of him but his vertebrate column and the silver wire.

The credit for the first systematic fish marking attempted either in America or Europe apparently belongs to Charles G. Atkins of the United States Fish Commission, who, at the instigation of Professor Baird, the founder and first Commissioner of the present United States Bureau of Fisheries, began experiments marking Atlantic salmon in 1872 at Bucksport, Maine, continuing these experiments over a period of years. The first definite mention of Atkins' work was in the 1876 report of the United States Fish Commission, which covered the various activities of the Commission from 1873 to 1875. A short article appearing in this report (pp. 490-491) entitled "Marking salmon for future identification" is the first printed reference to fish marking in the United States to the writer's knowledge. In 1885, Atkins read a detailed account of his experiments entitled "The biennial spawning of salmon" before the American Fisheries Society. Possibly because of its misleading title, this historical paper has failed to be noticed in recent works on fish marking, particularly in that excellent monograph "On Methods of Marking Round Fish" by Michael Graham, the English fishery biologist.

Atkins, although he attempted to mark salmon by branding the side of the fish and by cutting the fins into a variety of forms, found that the only method of marking suitable for actual experiments was the use of metallic tags attached to the body of the fish. The first tag tried consisted of a thin aluminum plate, stamped with a recorded number, and attached to a rubber band which encircled the tail of the salmon. No success was attained with this type of tag for the rubber bands apparently slipped off. The next type of mark was an aluminum tag attached to the rear margin of the first dorsal or back fin by means of a platinum wire. The aluminum tag did not stand up well in sea water and was later replaced by a plate, about a half inch long, and a quarter inch wide made of platinum. Atkins was the first investigator to offer a reward for the return of these salmon tags.

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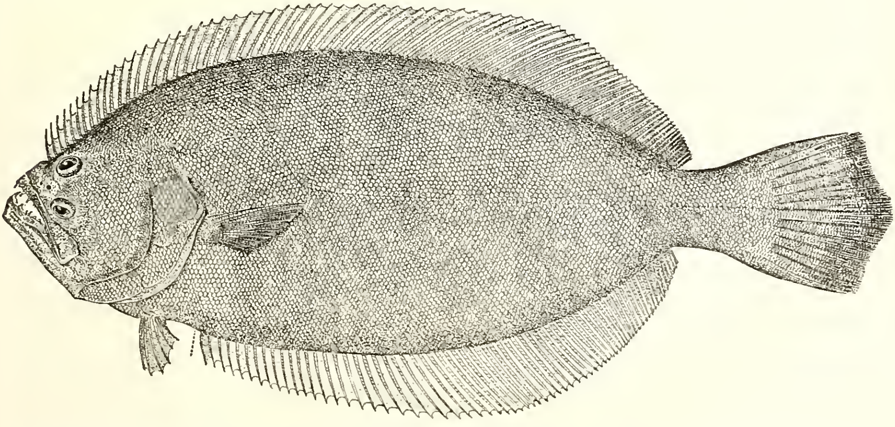
In 1884, W. E. Archer, a Scottish biologist who was conducting experiments in Norway, began marking salmon with a type of tag quite similar to the one used by Atkins twelve years before. Later, Archer developed another type of mark which consisted of a platinum or silver tag which was closely attached at the base of the dorsal fin with the ends of the wire tightly pressed along the fin. Afterwards, he united the free ends of the wire so as to make a complete ring about the dorsal fin. The tag plate was soldered to the wire.

Both the Archer and the Atkins tags are used to some extent by various European countries at the present time with certain modifications in structure and materials. However, both types of marks do not give perfect results for it has been found that the metal plates have a tendency to come off by reason of the wire pulling out through the fin.

A third outstanding pioneer in fish marking was T. Wemyss Fulton of Scotland, who began experimental fish marking in 1889 on a much larger and more thorough scale than did his two predecessors. While the latter confined their tagging activities to Atlantic salmon, a fish which migrates up into fresh water to spawn, Fulton tagged thousands of strictly marine fishes of many commercial species. Furthermore, he examined critically various materials that might resist the chemical action of sea water. Pieces of leather, guttapercha, india rubber, lead, copper, zinc, and brass were immersed in sea water for several weeks. Ultimately brass was selected as the most satisfactory substance then available. It was decided that the tag should be fastened around the tail of the fish. Thin brass circular disks, three-quarters of an inch in diameter, were used. Each disk had a consecutive number stamped on it and was pierced with two small holes by which it could be fastened to the fish with black silk cord which was selected as the best material for tying on the tag. Although only about five per cent on the average of his marked fish were recaptured, the experiments of Fulton yielded valuable information concerning the movements of some twenty-two different species of European food fishes.

After the preceding mention of early experiments of leading pioneers in fish marking, we might consider the modern development of fish marks or tags in a broader sense. Fish marks during the last quarter of a century have been generally of three distinct types, which, of course, are constructed and applied in various ways. These are the button or disk type, consisting of two disks attached by a shank of the same ma-

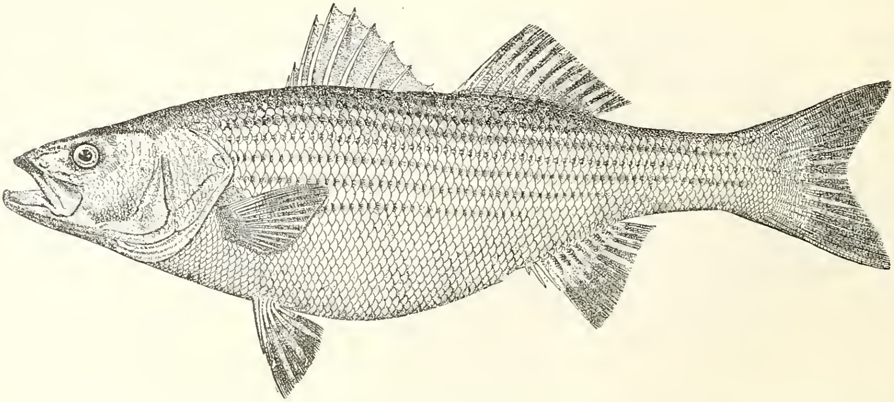


The Flounder (Paralichthys) and other related flatfishes have provided extensive marking experiments in the United States and Europe. Flounder tagging has been centered off the New England and Virginia coasts to determine the movements of fish between these points. The favored type of tag for flatfishes has been the disk type attached to the posterior part of the body. The Alaska Halibut has been marked successfully by means of the Gilbert or clip type of tag attached to the opercle or gill cover. The above illustration is of the common Gulf of Mexico Flounder, Paralichthys lethostigmus.

terial or a wire; a strap tag of metal, both of which types are attached externally to the fish; and the internal tag or belly tag, which is placed inside of the body cavity of the fish.

The first type, probably the most used at the present day, was first devised by C. G. J. Petersen, the Danish biologist, in 1894. This tag originally consisted of two bone buttons joined by a silver wire which pierced the tissue of the fish between the dorsal fin with a button lying along each side of the fish. This mark, now made of vulcanized rubber, has been widely used in Europe with satisfactory results, particularly on flatfish, and is often called the Scottish plaice tag. The most recent improvements on this type of tag have been made by R. A. Nesbit, a biologist of the U. S. Bureau of Fisheries, who devised thin red and white buttons, constructed of laminated celluloid, held together with nickle wire. This tag has been used on several species of marine fishes along the Atlantic Coast with good results in most instances. A recent marking experiment by the writer in upper Chesapeake Bay, tagging striped bass, has yielded a recovery of 30 per cent for 304 fish released during the summer of 1931. Tags have remained on some fish for over two years thus far. Such a mark as the improved Petersen tag has the advantage of remaining a considerable time on the fish since the disks are attached to the sides by running a wire through the muscles of the back, usually under the dorsal fin, and then bending the ends of the pliable wire so that the disks can not be lost except through the movement of the wire itself out through the flesh of the fish. Observations have shown that little infection or suppuration of the flesh occurs through the use of the tag provided the disks are not too tightly held against the sides of the fish. These red and white celluloid disk marks are very visible to the fishermen and as all disks have on them a serial number, together with the address to which the tag is to be returned for a reward, most tags found are returned. One disadvantage of this tag is the fact that, as the fish grows in girth, there is the tendency for the wire holding the disks to move out from the flesh and be lost. However, for short time experiments, let us say within a two year period, this type of mark seems to fulfill most requirements.

A second type of fish mark, often called the metal strap tag, was devised by the late Dr. C. H. Gilbert of Stanford University. This tag is essentially a metal clip fashioned after a type intended originally for tagging or earmarking cattle and sheep. Each tag consists of a flat strip of aluminum or monel metal on one side of which is a serial number and initials of the tagging agency. Close to one end a hole is cut, and the other end is flattened and sharpened into a sort of prong. A pair of tongs attaches this tag to the upper or lower lobe of the caudal fin of the fish by reason of the prong automatically folding over, after penetrating the hole at the other end of the tag, Returns from this type of mark, which has been used on thousands of Alaska salmon, have been as high as 36 per cent, all in the season of marking. This tag has also been used extensively with moderate results in marking codfish off the New England coast. Over 50,000 cod have been tagged since 1923 with this metal tag with a recovery rate of about 7 per cent.



The Striped Bass or Rockfish (Roccus lineatus) is one of the marine food fishes of the United States which has been tagged both on the Atlantic and Pacific coasts. Three hundred fish were marked in 1931 in upper Chesapeake Bay with the button or disk type of tag. This tag was placed slightly below the second dorsal fin of the fish. Recoveries of tagged Striped Bass have been ninety fish or thirty per cent of the total number marked. The recovery rate in California has been considerably less.

It might be stated here that another way of marking salmon is also practiced in Alaska on a large scale. Thousands of young salmon fry on their way to sea have been marked by cutting off two fins in various combinations for each experiment such as the dorsal and adipose fins. This drastic fin cutting, originally suggested by Atkins, has given good results in the case of the Pacific salmon. It is doubtful whether such fin cutting would be applicable to many species of fish excepting salmon for it is a mark not easily recognized or correctly reported by fishermen. However, in the case of the salmon, it has proved its value because it has been instrumental in establishing the parent stream theory of salmon migration.

A third distinct type of tag recently devised by R. A. Nesbit consists of a strip of red celluloid, properly labelled, which is pushed into the coelomic or body cavity of the fish by making a small incision in the belly wall. This marker is not discernible from the exterior, of course, but when the fish is gutted the tag comes to light and is readily recognized. Experiments are now in progress using this new type of tag extensively and preliminary results are most encouraging. Such a tag if successfully introduced inside the fish can not be lost, and is most certain to be discovered for all food fish are cleaned by some one. Such a concealed tag is, of course, not generally practical when information is required concerning the exact time and place of capture since few commercial fishes are gutted immediately following capture.

An interesting modification of Nesbit's internal tag has been devised by Dr. G. A. Rounsefell of the Bureau of Fisheries for marking herring in Alaska. Because of the delicate structure of these fish, the application of any of the types of external tags has proved unsatisfactory, and furthermore, because the great bulk of this fishery is manufactured into fish meal and oil, the recovery of external tags, which must depend on individual handling, would be most unlikely. Hence, a new method of securing the return of tags was essential to the success of a tagging experiment. Accordingly, small strips of metal, bearing the identifying numbers, were placed inside the body cavity of thousands of herring, and recovery was accomplished by mechanical sorting of the fish meal produced in the reduction plants, by using an electro-magnet in the delivery pipe from the reduction works. The metal tags, which are magnetic, were collected and held by the magnets, and since the locality of the fish in each day's run could be ascertained, the movements of the schools of herring from the point of tagging to the place of recapture were readily studied.

The three preceding types of fish marks together with the tags devised by Atkins and Archer comprise most of the marks now in use. Over thirteen nations of the world have officially engaged in fish marking as part of their scientific fishery research with most of these countries paying a reward for every tag returned. Such fishes as the Atlantic and Alaska salmons, codfish, haddock, halibut, flounders, brook trout, sea trout, striped bass, mullet, and herring have been the principal species tagged to date, although a complete list would include among others the common blue crab of the Atlantic and Gulf coasts, lobsters, sharks, sturgeon, and eels. Many thousands of marine fishes are now being marked along the Atlantic and Pacific coasts by fishery investigators. Conservationists, interested in the distribution of young game fishes into the fresh water lakes and streams of the United States are also tagging many fish prior to their release to ascertain the intensity of angling each year in various bodies of water and to determine, if possible, the rate of survival of the fish after the anglers have had their sport. The future possibilities in fish marking within the United States are great, but it must be stressed that only properly qualified biologists should undertake the experiments in order that the fish be properly marked in the first place, and that the data secured from such experiments be correctly interpreted. Every angler and fisherman can lend aid, however, by promptly returning any fish tag which may be found. The return of the tags is fully as important as the technique of tagging itself and only with the cooperation of fishermen can the biologist succeed in this phase of fishery research.

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Cone-in-Cone from Northwest Louisiana

By W. A. TARR
University of Missouri

CONE-IN-CONE is an unusual structural feature that occurs in sedimentary rocks, and, although world-wide in distribution, it is not of common occurrence. Its geological distribution ranges from the Cambrian to the Tertiary. It is of interest, therefore, to record a new locality in which cone-in-cone occurs and to know its geological age. Additional interest attaches to the specimen described below because it was secured from a drill core at a depth of 3,139 feet. This is the first time, to the writer's knowledge, that cone-in-cone has been found in a drill core. It may have been present in other cores but was not recognized, or, if so, not regarded as of interest. This new occurrence of cone-in-cone was noted by Mr. H. D. Easton in a core from the Gerhig Company well, Miller No. 1, in Sec. 16, Township 18 North, Range 10 West, about a mile northwest of Doyline, Louisiana. According to Mr. Donald Goodwill, Jr., engineer of the Louisiana State Department of Conservation, who submitted the specimen to the writer, the cone-in-cone came from the Post Glen Rose formation of the Fredericksburg of Lower Cretaceous age, which is in keeping with the fairly common occurrence of cone-in-cone in the Cretaceous formation in the Great Plains area of the United States.

Core showing cone-in-cone structure. The lower end of the specimen shows the parallel fibrous layers.

Cone-in-cone usually consists of a nest of concentric cones, which vary much in length. The majority are one to three inches long, although some attain a length of four inches. The sides of the cones may be fluted or smooth. The interior of the surrounding cone usually shows a series of annular rings parallel to the base of the cone. These rings are always filled with a dark clay-like material, which represents the insoluble material of the calcite of which the cones are formed. The cones show a fibrous internal structure. These fibers may be parallel or inclined to the axis of the cone and may or may not be parallel to the surface of the cone. Although most cone-in-cone occurs in fibrous material, the writer has some specimens of the structure in massive material. Probably, the most remarkable cone structure is that occurring in coal. The sides of such cones are beautifully slickensided and striated, as occasionally are those composed of calcite.

The section of the core from Louisiana, submitted to the writer, is about 4 inches long and 1¼ inches in diameter. Unfortunately, the upper or lower end of the core specimen was not indicated, so the position of the cone-in-cone in the bed is not known. The major development of cone-in-cone (1¾ inches in length) is at one end of the specimen. A dark shale is on the end. The other end of the specimen shows many small cones up to a half-inch in length. They are irregularly distributed through thinly laminated shale that has been displaced vertically during the development of the cone-in-cone. This zone of small cones nearly equals the length of the well developed cones on the other end, but the two areas are separated by a thin band (less than one-quarter inch) of laminated calcite that has been deformed to fit the apices of the cones pressing against it.

The larger cones are typical cone-in-cone structure, and show a series of nested cones. The fibers are dominantly parallel to the sides of the cones. The cones are acute, the apical angle (determined without sectioning or breaking the specimen) is approximately 28°, which is smaller than that of most cones. The cones are very uniform in slope from the apex to the base; only a few show a slight flaring at the bottom. One cone has an apical angle of about 30°. The inside of each cone contains the typical annular rings with their included dark-gray to black residual clay. Most of these rings are less than one-fiftieth of an inch wide, but a few are nearly one-eighth inch in width. Even the small aggregates of cones on the other end of the specimen show these annular rings, though they are so small few can be seen with the naked eye. The surface of the large cones shows the usual flutings and striations. A rather unusual feature of these cones is the presence of a thin (maximum thickness 1/16 inch) cap of residual clay *on the apex* of some of the cones. Its occurrence there is analogous to the cap of residual clay on a stylolite column. Some of the cone shells are very thin (1/40 to 1/50 inch), yet show the annular rings on the inside and the striated or fluted surface on the outside. The specimen is gray, and is lighter where it contains less clay. The cone-in-cone is composed of calcite.

Cone-in-cone has been known for 140 years. At first it was frequently regarded as a fossil. Numerous opinions have been expressed as to its origin, most of them of little value. These views are briefly summarized in an early paper on the origin of cone-in-cone by the writer,[1] and he has given a complete discussion of the origin and occurrence of cone-in-cone in "A Treatise on Sedimentation".[2] Cone-in-structure is formed usually in fibrous calcite, as a result of pressure accompanied by solution of some of the calcite. In fibrous material, the length and shape of the fibers and the presence of the rhombohedral cleavage of the calcite are probably minor contributing factors. That pressure is a factor is shown by the displacement of the cones relative to each other. This movement is accompanied by solution of the calcite, which gives rise to the residual clay. The pressure induces a strain in the fibrous calcite which is relieved by a shearing along planes that are probably induced by the cleavage of the calcite, but are not necessarily parallel to it. Solutions in following the shear planes remove $CACO_3$ and this permits the inner cone (several shear planes may develop from the pressure on the end of the fibrous calcite layer) to move downward (the *usual* direction, but unknown in the specimen under consideration). Not infrequently, this downward movement may amount to one-half inch or more.

In the Louisiana specimen, the crumpling of the thin laminated calcite layer at one end of the cones, the residual clay capping of the cones, and the extreme thinness of the cone shells show that movement and solution has occurred. The small irregularly distributed cones in laminated shale on the other end of the specimen show even better that considerable movement has accompanied the development of the cone-in-cone. The depth from which this specimen came means, of course, that the pressure was great, the results of which are doubtless reflected in the evidence of movement just noted. The parallelism of the fibers within the cone is probably due to the removal of the outer portion of the fibers, permitting their deflection which would be toward the surface of the cone. The annular rings start at the *ends* of the sheared fibers, the pressure on them aiding solution at that point. These fibers surround the cone as a ring.

Some men have thought that cone-in-cone was formed originally of aragonite, the orthorhombic form of $CaCO_3$, but the writer has never found any cone-in-cone composed of aragonite. Tests showed that the Louisiana cone-in-cone is calcite.

By way of summary, we note that the cone-in-cone found in a well at a depth of 3,139 feet (in lower Cretaceous beds) is a typical example of this interesting structure of sedimentary rocks. This cone-in-cone developed in a fibrous layer of calcite in shale. The specimen shows undoubted evidence of movement and solution work, which is in keeping with the present view of the origin of cone-in-cone; that is, that pressure (in this case the weight of 3,100 feet of sediments) and solutions have induced the structure in the fibrous calcite. This new occurrence from a great depth furnishes a valuable contribution to our knowledge of cone-in-cone.

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[1] Tarr, W. A., "Cone-in-Cone", Am. Jour. Science, vol. IV, 1922, pp. 199-213.

[2] "Treatise cn Sedimentation", 1932, Cone-in-Cone, by W. A. Tarr, pp. 716-733.

The Great Migration of Birds Begins in Spring at Grand Isle

By GRACE MANNERS

EX-PRESIDENT Hoover said that what this nation needs is a great poem. Grand Isle, Louisiana's own Beach resort, historically known as the stronghold of Lafitte and his Baratarians, open now to throngs of visitors, because of the new highway that brings one right onto the island, is a living poem at every season. But, at Easter time it is a symphony of beauty.

Gull-Billed Tern

Easter lilies bloom there in the open, the white sandy beach and white topped surf is backed by a wealth of colorful spring flowers, luxuriant shrubs, age old oaks and lanes of stately palms.

With Easter Sunday, this year, begins the great migration of birds at Grand Isle.

Giant Oak at Grand Isle

Grand Isle, for geokraphical reasons is the last outpost in the Gulf of Mexico, the first land fall for birds in their long flight across the Gulf, from Mexico, Central and South America to their nesting places in northern latitudes.

Observation by scientists over a period of years appears to establish that the lines of bird flight from the tropic and temperate zones on the other side of the equator, decidedly converge on Grand Isle.

Here the birds rest, after their long and exhausting flight, feed and drink the fresh water of island pools for weeks before taking their more leisurely flight northward.

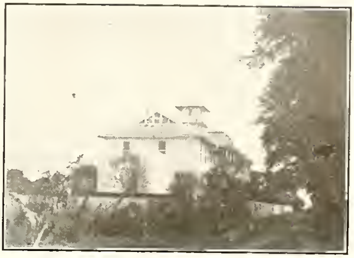
Bird lovers have a rare opportunity during the congregation of birds at Grand Isle to see and study a wide variety of species, for they naturally are dispersed over broad territory when they leave the island.

On St. Valentine's Day, the Purple Martin heads the Spring processional of birds, followed, during March by the Western Parula Warbler—charming birds, yellow bodied, brown winged—the Hooded Warbler, with yellow domino mask, the Prothonatory Warbler, named because of his yellow coat, fancied resemblance to the notary of olden days whose court dress was a yellow robe. Last of the March birds come the Black and White Warbler, and Orchard Oriole.

But in April, which this year, commences auspiciously with Easter Sunday, begins the great migration.

The Kentucky Warbler throng are among the first of the April birds to arrive, in Easter coloring of bright yellow, followed by the flight of Indigo Bunting—birds of gorgeous blue. Then, bevies of Yellow Warblers and Cerulean Warblers of heavenly blue, Oven Birds—very cheeky little fellows, and brilliant Scarlet Tanagers, a many hued flag of birds signalling their

An Interesting Panorama of One of the South's Bathing Beaches the Like of Which Grand Isle Envisions for Herself at a Not Distant Day bright colors in the sunshine of Grand Isle.



An Old Landmark

During the crest of the migration in April, travelling according to the characteristics of their kind in mixed company, as those of the Warbler and Sparrow families, or strictly with their own group, as does the Night Hawk—Grand Isle is literally alive with birds—Thrushes, Gnat-Catchers, Vireos, Orioles, the Yellow-Breasted Chat, the Bob-o-ling, the Baltimore Oriole, the Summer Tanager, the Dickcissel, a miniature meadow lark in appearance.

Scarlet Tanager

Then, birds of sober plumage and ringing song, the Grey Cheeked Thrush and the Veery, named for its cry—the strange Night Hawk, which appears only at twilight or just before dawn and cries on moonlit nights. Long ago, the Night Hawk nested only on the ground, but, today makes its nest, also on the roof tops of cities.

Characteristically, the birds remain quiet, during the day in trees and shrubbery so luxuriant at Grand Isle. The protective bird instinct chooses night for migration flight. They are most conspicuous at the earliest hours of morning, or late evening, before sunset.

Can you picture a more inspiring experience than the dawn hours at Grand Isle this Spring? After the soft and solemn hush at the breathless moment of daybreak over spraying surf, white beach and spring verdure, when the great congregation of birds furl their brilliant hues against the sunrise and the galaxy of song birds ring out their joy and praise.

Ludwig's Lane of Oaks, Oleanders and Palms

The ways of birds, like the ways of women, still retain much of the illusion of mystery; much remains unexplained to scientific observation as to the origin of bird migration and the logic of it.

Why do birds traverse the great distance from the temperate zone of South America and the tropical countries, to the temperate zone of North America and back again—to find something in many cases not so good as that left behind?

And deeper, even more mysterious, whence this accuracy of direction finding, during the night flying of day birds?

Southern Meadowlark

There is, of course, a Fall Migration on the return of the birds southward, but it is not so condensed at Grand Isle, nor, do the birds remain so long. They are not so tired after their leisurely land flight, nor so concentrated in numbers as they are after the long and hazardous flight over the Gulf of Mexico.

Off Grand Isle, during the summer months, the bird student can see such unusual sea birds as the Stormy Petrel, or Mother Carey's chicken. The name recalls the sailor call for his "Mater Cara," his Sea Mother—irresistible to those who feel its yearning.

Occasionally, at Grand Isle, one may find such sea birds as the Atlantic Blue Faced Booby—deemed by sailors, a dumb bird; the Yellow-billed Tropic-bird, a peculiar animal, plumaged in black and white, flies like a pigeon, looks like a tern and has two, long, slender tail plumes.

Mother Carey's chickens are the only birds known to nest in South America during the winter and spend the summer vacationing in the North.

Summer bird life at

Grand Isle is extremely interesting. Least Terns nest in great numbers in adjacent islands, and throughout the year Brown Pelicans may be observed carrying on their ludicrous fishing operations. The White Pelicans are common winter residents, but nest in higher latitudes.

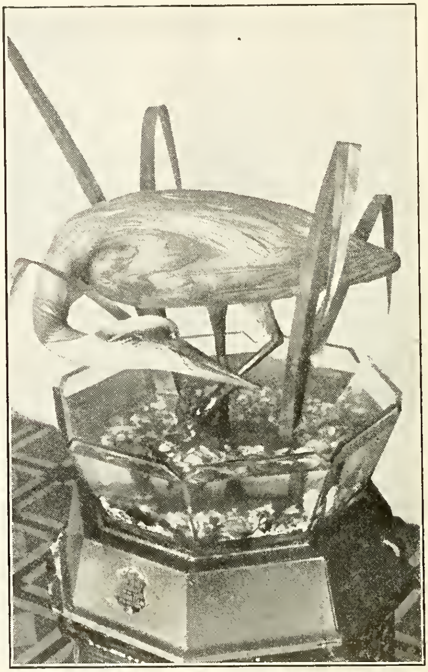
Among the terns at Grand Isle are: the Caspian Tern, the Forster Tern, the Common Tern, the Royal Tern and the Cabot Tern—all commonly called "Les Hirondelles de Mer" or sea swallows.

One of the most interesting, noisy and remarkable of all the common water birds at Grand Isle is the Black Skimmer, notable for its strange, elongated lower bill by means of which it skims the surface of the water for food. The Skimmer nests abundantly on low lying islands near Grand Isle.

BEAUTIFUL AQUARIUM INTRODUCES NEW PRINCIPLE*

Art lovers and goldfish fanciers will be delighted over the beautiful aquarium, patent No. 1,858,181, designed and invented by Honorable Gaspar R. Bossetta of the New Orleans bar. It is modeled in the form of a large blue heron standing among the tall grass and shallow water of a Louisiana swamp. A single drop of water constantly falls from its beak into the aquarium bowl, while through a perfectly operated syphon, hidden in the bird's leg, the impure water is carried off, drop by drop, into a reservoir below. There is no plumbing connection, and until the mechanism is explained ,the observer wonders where the water comes from and where it goes.

It is seventeen inches high over all and seventeen inches across. The hollow bird is of metal, and contains a gallon of water when full. The bird's bill contains a concealed valve, which regulates the drop, thus keeping constant circulation and aeration of the water. The glass fish bowl holds also a gallon of water, the level of which is constant, for the excess water is taken care of by the syphon action in the bird's crossed leg. The octagon base is three and a half inches high by seventeen inches, is made of aluminum, with an aluminum drawer of over a gallon capacity.


Unique and Beautiful Fish Aquarium, With Self-Aerating System

The only attention necessary is that of emptying the drawer once daily, and of replenishing the water in the body of the heron. The total weight is thirty-five pounds, and it is easily moved by the handles on the base.

The bird was modeled from a real Louisiana heron by Romeo Celli, noted sculptor of New Orleans.

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*Letters requesting further particulars regarding the Louisiana Blue Heron Aquarium, should be addressed to Hon. Gaspar R. Bossetta, 602 Conti St., New Orleans, La.

COMPLIMENTS

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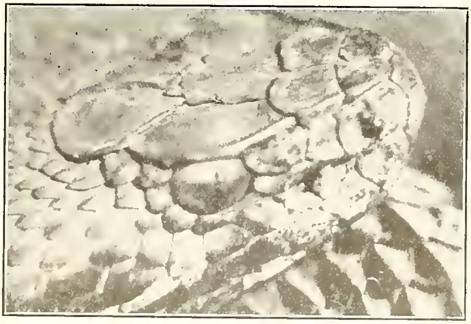
PHOTOGRAPHING NATURE'S MINIATURES

By B. F. LEEPER,
New Orleans
With Photographs by the Writer

THIS article does not deal with miniature photography in the Leica, Contax, etc., sense, since the method hereinafter discussed is, in a manner, the reverse of the technique ordinarily used with these small cameras. Not that I haven't the greatest respect for this type of instrument and the results obtained by experienced workers, but the initial cost is great and I, personally, have never succeeded in getting equally as good results as with the larger film.

But, to keep within broadcasting distance of the subject, rather than precipitate a photographic argument, whether you do it as an amateur for the entertainment of yourself and your friends, or as an aid to scientific study, there is a great deal of interest, amusement and diversion in making photographs of minute, almost microscopic insects, plants and flowers; or in great enlargements of small portions of larger objects, such as a snake's eye, or crawfish's head (crayfish, if you insist—it won't change the flavor).



Here the observer looks into the sinister face of a Rattlesnake. Observe the "Pit", characteristic of all crotalid snakes, located almost midway between the eye and the nostril. Note, too, the cat-like appearance of the eye.

If you are interested in such subjects it will hardly be necessary to point out the varied uses to which they may be put, running from natural design to scientific study. The ease and lack of strain with which the whole, or a part, may be studied and compared with another, give the photographs an appreciable advantage over the microscope where the enlargement factor is not necessarily excessive.

Let it be understood that the present discussion does not take into consideration the use of the microscope in making the photographs, since relatively few amateurs have them available.

Photographically the problem is rather simple and there are many combinations which may be used to get approximately the same results, but many of those used in even the most finely equipped laboratories and hospitals are so bulky and cumbersome, while others are inaccurate and unreliable that a discussion of the general principles, while quite dry, may be of some assistance.

The general idea is to get as large an image on the film as is compatible with the subject, the requirements and the sensitive material available and then enlarge the negative in the customary way.

Most of our article will deal with the film image.

The basic requirement is that you have a lens whose focal length is short as compared to the bellows extension of your camera.

Preferably a two inch or a three inch lens with a rating not slower than *f* 4.5; a longer focal length may be used with more bellows, but this makes a more cumbersome outfit. The camera should be of the double extension type, or else a view camera. The former being much more compact as a rule, while 5″x7″ view cameras are usually available at almost any pawn shop at a very low price and have the advantage of longer bellows draw and consequently larger magnification. The view camera is, however, more difficult to operate in the open.

My own preferred equipment is a Graflex with double extension. A reflex camera *does* have advantages, but if you choose one, be certain that it has sufficient bellows capacity, since the majority of those on the market can be used with only a lens of single focal length.

In using the Graflex the focal plane shutter is not usually satisfactory as the exposures are frequently longer than are supplied automatically by this shutter and the rather awkward method of taking time exposures results in frequent blurs from camera movement, so get a lens fitted with a good interlens shutter of the Compur type giving accurate exposures up to a full second automatically, or, as I have done, use a lens mounted in a barrel, be sure that it has an iris diaphram) and mount an interlens shutter behind it.

While every advanced amateur is thoroughly familiar with the meaning of the "*f*" system of marking lens diaphrams, satisfactory results in this type of work are so dependent upon this knowledge that I would rather go to unnecessary length for those whose use of the camera has not been so extensive than to have them get the inconsistent results caused by insufficient information.

The *f* readings of the diaphram scale are the ratios, at the respective settings, of the diameter of the light opening in the lens to the focal length (or roughly, the distance from the lens to the film) when the lens is focused at infinity.

Illustrative: if the reading is *f* 8, and the lens is of 4″ focal length, the opening is one-half inch in diameter. Since the *f* number is, in effect, a denominator, and since the area of circles vary *directly* with the squares of their diameters, the amount of light transmitted by the leans varies *inversely* with the squares of the *f* numbers. That is, *f* 4 transmits four times as much light as *f* 8, sixteen times as much as *f* 16 and sixty-four times as much as *f* 32.

This Jumping Spider, thus enlarged, becomes a grotesque yet fearsome monster. Note the two pairs of eyes. Three or four pairs are the more usual number.

And now is where the joker comes in. All of the above is based upon the lens being focused upon infinity (a couple hundred feet and onward from the camera, photographically speaking) while the actual conditions under which we are working are such that the lens is focused upon an object only a few inches or less from the lens.

Practically every modern lens is marked with its focal length either in inches or centimeters, or the information may be had from the maker, but you may determine it fairly accurately without even a camera by taking it into a not too bright room, pointing the lens towards a window and with a sheet of white paper held behind it, at right angles to the axis of the lens, move the lens back and forth until a sharp image of some fairly distant object is thrown on the paper. Measure the distance from the lens to the paper.

With the focal length of the lens known, one of the first things to do is to mark off a scale, either directly on the camera, or on an auxiliary ruler, giving focal lengths and half focal lengths and, unless you feel that you need the stimulus of mathematical gymnastics each time you take a picture, make up a table showing the *f* ratings (actual) for the lens at each opening at each indication on the scale.

If the above is not quite clear, let's assume that we have a three inch lens and that the markings may be conveniently made upon the camera. At three inches from the plane of the film we will mark "1 x"; at four and one-half inches mark "1½ x"; at six inches, "2 x"; at seven and one-half inches, "2½ x", etc. On our scale then, at "1 x" the readings will be the same as the diaphram indicator; when the lens is moved to "1½ x" the diaphram reading *f* 4 would actually be *f* 6; at "2 x" *f* 4 would actually indicate *f* 8, and at "2½ x" *f* 4 would become *f* 10.

From this it follows that if we make a correctly timed negative at "1 x" and with the light, general coloring of the subject and shutter speed the same, take another photograph at "3 x", with the same diaphram opening, the second will have received only one-ninth as much light at the first and show consequent under-timing.

Depth of focus is often a more or less serious problem in this class of photography. The rules are that the closer the object to the lens, the shallower the depth of focus and the wider open the diaphram, the less the depth of focus. Where the set-up as made does not give sufficient depth, the first step is, of course, to close the iris; if, at its smallest opening this is insufficient, move the object further away from the lens and be content with a smaller image.

In the first part of the article it was said that the lens should be *f* 4.5 or faster. The reason for this is not because of the necessity for speed, since after focusing the lens is almost invariably closed down a considerable degree, but due to the fact that the light reflected from the object is thrown over so much plate area, it is very difficult to focus critically with a lesser amount of light.

So much for the camera and lens; now let's take up the film and film container.

My opinions in this regard could probably be the subject of considerable controversy, but I give them for what they are worth.

I heartily favor the 6x9 cm. film pack, because it is the largest thin film available at the present time in the fine grain orthochromatic and panchromatic emulsions; it is convenient, cheap and, in some grade, may be purchased almost anywhere. So the first thing to do is to make a back to take the 6x9 cm. (2¼"x3¼") pack.

To make this back, make a blank the same shape and size as the regular plate holder, or film pack adapter; cut an opening in the center of the blank 2¼"x3¼". Then determine from the plate holder the exact distance that the plane of the film is from the front of the holder; from the back of the blank recess and opening large enough to accommodate the film pack, being careful that the pack is held exactly at right angles to the axis of the lens and that it is exactly at the same depth as the plate would be in the plate holder (otherwise your camera will be out of focus). Hinge on a back and paint the whole a dead black.

This description is not particularly clear, but it would be difficult to explain for even one particular type without taking up a lot of space with drawings, while nearly everyone with the general idea can work out his own adaption.

It may be necessary to somewhat change the hinging of the ground-glass on the view type of camera, but this is not difficult.

Undoubtedly it is best to build the film holder with a dark slide as the plate holders and adapters are built by the factory, and so I attempted to make mine, but despite the two strips of velvet and the excessively long distance between the edge of the film and the opening in the holder, a decidedly unnecessary amount of light managed to find its way in, so I eventually sealed up the end and prefer to waste an unexposed film when I take the back off to having the chance of good pictures becoming light-struck.

In developing the film, fine grain developer should be used to preserve all possible detail. I find that the Eastman D-76 formula gives very satisfactory results, though there are other ready prepared developers that give silghtly better results at a good deal higher cost. For any reasonable enlargement this borax developer will be found to be entirely satisfactory and very economical to use: Elon (or Metol), 116 grains; sodium sulphite, 13¼ ounces; hydroquinone, 290 grains; borax, 116 grains; water, 1 gallon.

This developer will keep well and although it gets very muddy, this does not affect the time or quality of the development.

If you are making your own enlargements, unless you have lots of projection room, it is desirable to have a comparatively short focus lens in your projector, although it must be of greater length than that recommended for the camera; four inches being about the minimum for the above mentioned negative.

The above statement may not seem reasonable at first glance, since the photograph was made with a very short focal lens, but the conditions are now reversed.

This flower of a common species of lawn grass reveals a bizarre beauty when photographically magnified.

An old photographic axiom is that the focal length of the lens should not be less than the greatest diagonal of the plate that it is to cover. This was applied to lenses working near their normal focal length. If, however, a lens is very near the object and quite a distance from the plate, it will cover an area far greater than its rating; in fact about the only limit is the distance that the plate may be removed. In making an enlargement from this same negative the lens will be working very near its normal focal length and will no longer cover the whole plate.

If we use a lens of excess focal length our magnification ratio will be more limited by the physical limits of our enlarger. For instance: assuming that your enlarger is arranged vertically, which is the predominant type, and that it is equipped with an eight inch lens, the lens being five feet from the floor when focused, the enlargement ratio will be limited to a little over seven to one, whereas, with a four inch lens in the same space you would be able to get nearly sixteen to one.

In the latter case, if the negative were three times as large as the original and is then enlarged to the limit, our final picture would be about a forty-five diameter enlargement of the object. (The reason for all the "abouts" in the preceding paragraph is that the eight inch lens focused at five feet and the four inch lens focused at five feet four inches are both at a little greater distance than their focal length from the negatives, consequently reducing the ratio somewhat, and my estimates may be further off than I think, but I haven't measured it and won't calculate it, so that's that).

Remember that in making a sixteen time enlargement the area of the paper covered is two hundred fifty-six times as great as that of the negative and even with a fast enlarging paper considerable exposure is necessary, so unless you have a well cooled source of illumination, care must be taken to prevent spoiling the negative by buckling, and it may be necessary to make the exposure by installments, allowing sufficient time in between to cool the unit to a safe temperature.

I use daylight exclusively for my enlarging and except that the working time is limited, it is the most satisfactory method that I have found. There is no danger whatever of overheating the negative and the slowest types of papers may be used with safety.

Other auxiliaries, often useful and sometimes necessary, are a base that can be fitted to the camera with a tripod screw, on which there is a sliding table that can be locked in place with a thumb screw, where specimens can be placed and focused; a piece of white satin and a piece of black velvet for back ground use; a number of wire pins about eighteen inches long and a strip of sheeting, so that in photographing flowers in their native environments, the breezes may be reduced to minimum. You really have no idea how unstill a nice still day is until you try to photograph a long stemmed flower. Even the shrinking violet will dance with apparently no provocation when you try to focus on her.

A glass box is a great aid in handling insects, amphibians, and small reptiles, and it is preferable that the bottom of the box be also of glass so that the most advantageous back ground may be used. I used an ordinary drinking glass for the accompanying spider photograph, this pose was struck when the spider tried to climb the side.

A caution in photographing snakes: contrary to the common opinion snakes can not stand excessive sunlight and I believe that it was Dr. Ditmars who was the authority who stated that he had had snakes die while photographing them in full sunlight in midsummer. In spring and fall there seems little danger since they enjoy sunning themselves as long as the weather is moderate, but if you have any pet snakes to photograph in July, don't keep them in the sun longer than necessary.

THE GODS OF THE WOOD

You, who go to the woods when spring has come
  With her beauties of leaf and flower,
Who feel the urge to possess these gems
  If for only the space of an hour;
Who forget there's a law that says "Conserve,"
  As right-minded people should—
Are you not afraid, as you rifle and rend,
  To offend the Gods of the Wood?

You soil the streams and defile the glen,
  You slash the tree's fresh bark,
You pilfer the heart of the pine's green crest,
  You still the song of the lark.
You're ruthless, careless and full of greed,
  You destroy things lovely and good,
You trample, you sully, you vandalize—
  You offend the Gods of the Wood!

You strip the limbs of the dogwood white,
  The fronds of the fern you break,
You tear the blooms from jasmine vines,
  And the azalea's buds you take.
You bend, you twist, you split, you rob—
  Alas! that anyone could!
You spill, as blood, the living sap—
  You offend the Gods of the Wood!

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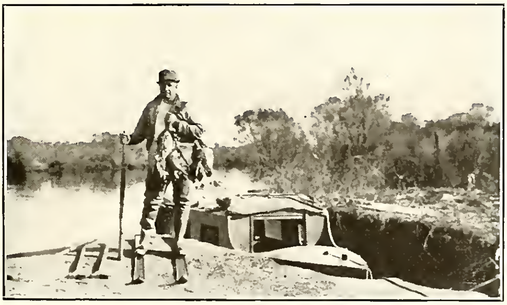
SNOW SKIS FOR MARSHLANDS!

By DR. WALTER WHITE FIFE

Editor's Note: Dr. Fife is a well known Louisiana sportsman, a champion of wild life preservation and director of Fife Brothers' Health Institution of New Orleans. His accompanying account of "Snow Skis for the Marshes" in response for a story, will no doubt prove an innovation worthy of much discussion and speculation to our readers.

Dr. Walter White Fife

THE sport of Skiing over Louisiana marshes in quest of the wily web-foot is of itself, not half so important as the fact that it provides a new and fascinating means of studying and enjoying a unique contact with the life of the South's natural wonderland—to search for the secrets hidden in the fastness of certain marshy areas never before trodden by the foot of man. There to rest and think, and appreciate the gift of life and of our free agency: to live at will—the right to go up and onward or back and downward; knowing always that a just reward or penalty are the two alternatives which accompany every human experience without equivocation.


The author bags the limit using snow skiis and marsh sled instead of a pirogue for transportation.

Skiing the marshes also affords wonderful recreation. It is more fun to skip over those boggy uncertain lands and shallow lakes and lagoons than one can imagine. Of course, it demands some practice. But with a pair of standard seven foot snow skiis and a couple of improvised Alpine sticks, the average person can soon overcome the apparent awkwardness and enjoy skimming marshy places so uninviting heretofore, without knowing the feel or fear of the bottomless bogs which lurk beneath a trusty pair of skis.

One morning at dawn, just as I was striding across a shallow lagoon dragging my small marsh sled laden with regular hunting equipment, there came in view a native trapper. He was tirelessly tugging at his push-pole in an effort to pass over a mud-flat. My appearance suddenly startled him. He turned his pirogue quickly and disappeared. That evening excitement ran high with the bayou trappers and on my return to camp I learned of the story that was being circulated. One of them had surely seen Christ walking on the water. Simply because no one had ever before been seen walking over those parts without sinking waist deep in the mire. I smilingly remarked, "No! No! It couldn't have been Him, but that it must have been one of His children."

You ask, "did I get the ducks?" The accompanying snap is proof of the pudding. And can the little boat really travel alone? Yes, we certainly do reach unusual places in this little outboard-motor cruiser too.

Most people think outboards unsafe for long cruises. "Lil' Miss" seen here, is powered by a 36 H. P. Elto Quad outboard, has a cruising radius of 100 miles, is eighteen feet long, has a top speed of 28 mile per hour, a cabin that sleeps three comfortably, electric lights, cooking stove, a radio and is equipped for all-weather travel. Yes, it's my own design. I give it good care and it gives me good service. By the way the cabin frame is covered with masonit—very satisfactory.

The most interesting water-ways of Louisiana are neither safe nor accessible to regular inboard motor boat travel. The modern outboard is dependable and inexpensive.

This spring, order a pair of regular snow skis from Sears, Roebuck. They are inexpensive and explore the marshes on foot. Its fascination will both charm and amaze you.

Every boat owner should carry a pair of skis as a part of his regular equipment, even for emergency travel, to say nothing of their value for scouting purposes.

GOB HUMOR

(From U. S. S. Tennessee Tar)

Stranger to man fishing—Caught many fish today?

Fishman—About twenty-four bass.

Stranger—Do you know who I am? I'm the game and fish warden.

Fishman—Do you know who I am? I'm the biggest liar in this county.

Louisiana Nature Guardians

"Upon my honor, as a Louisiana Nature Guardian, I promise to take care of all our natural friends, to guard and protect them to the best of my ability, and as far as possible influence others to do the same."

HOW YOU CAN BECOME A NATURE GUARDIAN

YOUR PART

Consult your teacher.

Ask that the purpose and plans of the Nature Guardian Club be explained to you and the class.

Ask for an application card.

Get a responsible person to indorse it, after proving that you fully understand the duties of a Nature Guardian.

Sign the application and mail the card postpaid, or give to your teacher, to send with cards from all the class.

OUR PART

We send the application card.

We send you a handsome badge, a certificate of membership, Nature Guardian pamphlets, and other literature.

This is all free, and is carried on with the purpose of instilling in the children's minds a knowledge of Louisiana's wild life and a thorough understanding of its economic value to the State.

It also aims to develop individual humanitarianism. Even within this short time an amazing improvement has been made in the mental attitude of our young folks toward the conservation and protection of Louisiana's natural resources.

EDITORIAL

I heard a man remark the other day that few people give more than a passing thought to conserving the natural resources of Louisiana. I immediately challenged the statement. I had proof, in plenty, that he was wrong.

Can you imagine what made me so certain? Merely the fact that we have thousands of Nature Guardians in the schools of the State; that we have hundreds of teachers who are members, and who teach Conservation in their classes DAILY, not simply stressing it at the monthly Club meetings, though there it is the paramount topic; that there are thousands of graduates who have gone out from the schools into various walks of life, carrying into their new activities the gospel of Conservation.

Do you think they will ever forget the lessons that have made them love the wild birds and flowers and appreciate the many blessings that a kindly Providence has showered on our State?

I have too much faith in our Nature Guardian training, in the significance of our Oath of Allegiance, to believe that Guardians will ever deny their creed or forget the principles they have been taught.

Our Guardians are already exerting a powerful influence for good all over Louisiana, and in other parts of the United States, where we have many honorary members. Each day brings letters to my desk telling me about efforts being made to preserve our wild life, flowers and forests. Each month more people apply for copies of our carefully compiled laws on hunting and fishing. Each summer finds more people camping and hiking, and studying nature at first hand.

So, my dear Guardians, have faith in your Club and in your Crusade, as I have faith in You and your Cause.

With affection for all Guardians,

THE EDITOR.

Here is a little rhyme by one who signs himself "Bayou Willie."

POOR LITTLE LOGGER-HEAD!

O, little Gray Bird, what an awful name!
What hast thou done to merit same?
Is it because you'll sit all day
In one quiet spot, with nothing to say?
But isn't it true you resemble a bird
Whose chief aim in life is to make himself heard?

From early dawn and all through the night
His wondrous song is his soul's delight;
And he thus proclaims as he goes along
That life's made happier by a song.
O, little Gray Bird, thou canst not sing—
But God's made good in everything!

Strange that we should have two poems on the Logger-Head, and quite different in thought. This comes from the Greenwood School, where Miss B. L. Leppert has formed a fine Club. She writes:

"DEAR EDITOR: We received the certificates and badges some time ago, and thank you very much for them. My pupils are enjoying the Club and working well. I manage to have one or more visitors at each meeting. My pupils have composed some poems, of which I am proud, and I hope you can use them in the NATURE GUARDIAN Corner of the CONSERVATION REVIEW."

THE LOGGER-HEAD SHRIKE.

(By Flora Belle Callen.)

The Logger-Head shrike is a beautiful bird—
His coat is of white and brown;
His nest is made of sticks, feathers and strings,
His breast is of softest down.

THE MEADOW-LARK.

(By Delta Berry.)

This spotted bird, with glittering eye,
Teaches her little birds to fly.
She runs in the fields, calling "Chip! Chip! Chip!"
Her little ones following, saying "Pip! Pip! Pip!"
Running up and running down,
Always fluttering around,
Scratching in each hole she finds,
Getting worms most of the times.
Soon they are grown and gone,
And Mother Lark is left alone.

THE BLUE BIRD.

(By Viola Nichols.)

In the morning when I arise
There's a blue bird in the skies.

It is blue with a reddish breast,
And everyone knows it is the best.

Please don't harm him, for he's good.
He eats the worms out of the wood.

I think that the Greenwood School should be happy to have such bright pupils, don't you think so, too, Guardians?

* * *

Here's a letter from 'way down in Cameron Parish! We are glad to hear from Doris Toerner, who says:

"DEAR EDITOR: I have been reading the LOUISIANA CONSERVATION REVIEW, and as I love birds and outdoor life, I decided I wanted to become a Guardian. So please send men an application card.

"I am fourteen years old, and I'm in the high seventh grade. I'll try to send you a poem about the oak tree when I write again. Hoping to hear from the Guardians soon, I am,

"DORIS M. TOERNER,
Creole, La."

* * *

Miss Callie Walker of Eros, La., has a most enthusiastic Club. I am sure you will believe it when you read her letter and take a look at the interesting program that was rendered on March 15, at the Eros High School. Miss Walker says:

"Enclosed you will find some material to be published in THE CONSERVATION REVIEW, if you see fit to do so. I have a very interesting Club, and the members are anxious to have something published. By using the material sent to us by the Department of Conservation we are learning a great deal about the natural resources of our State."

Here is the program on "Wild Animals in Louisiana":

1. Song, "The Fox and the Goose"..........All
2. Recitation, "Kindness to Animals"...... Edith Gaston
3. Ten-Minute Talk on the Wild Animals of Louisiana ....Juanita Ashford
4. Reading, "The Sassy 'Possum"......... La Voune Barnes
5. "Life of the Beaver"..........W. H. Pilcher
6. Recitation, "The Squirrel"............. Dorothy Jean Phillips
7. Story, "Why the Opossum Has a Large Mouth" ....Jack Ray Zeigler
8. Song, "America" ....All
9. Reports on Protection and Kindness to Louisiana's Wild Life.
10. Recitation of the Nature Guardian Pledge in unison.

Jack Ray Ziegler is President and Juanita Ashford, Secretary.

I wish all Clubs would send in copies of their programs.

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SUGGESTED PROGRAM FOR LOUISIANA BIRD DAY

(Which Occurs on Friday, May 11, 1934)

Song—"My Louisiana."
Recitation—"The Spring of the Year."
Recitation—"What Does Little Birdie Say?"
Song—"America the Beautiful."
Dialogue—"Fun for the Birds."
Recitation—"The Woodpecker."
Reading—"Bird Conservation Is a Necessity."
Song—"A Robin in the Spring." (From the La. Bird Primer).
Recitation—"I Wonder."
Song—"America."

FUN FOR THE BIRDS

(Dialogue for Four Small Children)

MOTHER BIRD

"Little Birdies, tell me true,
What you like the best to do?"

FIRST BIRDIE

"My greatest fun is to fly and play
Among the tree tops all the day."

SECOND BIRDIE

"I like to sing sweet songs of mirth
To brighten up this dull old earth."

THIRD BIRDIE

"Bugs, worms, and seeds taste good to me,
I save the farmers' crops, you see."

FOURTH BIRDIE

"My pretty wings I like to spread
And show their colors, brown and red."

MOTHER BIRD

"Well, children dear, I see that you
All have some jolly things to do.
And since you've been quite good today,
I'll let you go outside and play."

E. V. C.

BIRD CONSERVATION IS A NECESSITY

(Suggested by Garrard Harris' "Elements of Conservation.")

In spite of the fact that one of the greatest bird artists of the world spent so much of his time in Louisiana, comparatively few people in the past realized the fact that birds are a definite factor in the economic welfare of Country and State.

Some scientist has estimated that all human and animal life would cease within the space of seven years from the date of the extermination of all birds. Such a statement is staggering, but easily acceptable when the following facts are understood:

> Insects and worms strip the forests and fields.
>
> Without forests to regulate the water flow, torrential rains would wash great ravines in the earth's surface.
>
> The earth would be bare and sterile, baked by the heat of the sun, and swept by the winds.
>
> The insects would be the last to survive, because, without animal or vegetable food, Man would die.

"THE BIRDS, ALONE, STAND BETWEEN US AND THIS CATASTROPHE."

Birds fight, as a vast army, on the side of the farmer, saving the orchards, fields and forests. Surely, all the people of Louisiana should protect the birds.

This may be done by wisely enforcing the Conservation laws affecting migratory and resident birds; by planting trees and shrubs which offer coverts for nesting birds; by protecting eggs and nestlings from cats and other marauders; by teaching boys to refrain from killing birds with air-rifles or sling-shots.

A very potent factor in teaching the importance of bird protection is the organization of Louisiana Nature Guardian Clubs in the schools of the State.

Are YOU a Nature Guardian? Have YOU a Nature Guardian Club in YOUR school?

I WONDER!

I wonder if the stars above
Are brilliant birds that swiftly fly,
Spangled with blue and silver bright,
Across the meadows of the sky?

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OYSTER BEDS AND OIL WELLS

(Continued from Page 2)

building up of such a definite gradient. It must be emphasized that the hydrogen sulphide itself, in the light of these investigations, is not regarded as the most significant agent in relation to oysters in such pollution, but, nevertheless, it does serve as one index of the change wrought in the region.

4. Oil wells, under these conditions of production, produce varying quantities of gas which was formerly permitted to bubble freely up through the sea water, contributing to it, in varying concentrations, numerous soluble compounds. Hydrogen sulphide again demonstrated, by its increased concentration, the definite effects of the contact of such gas with the sea water of open bays. Furthermore, this gas is frequently used to "lift" the oil where natural pressure proves to be insufficient and therefore this gas, originating either from the same salt dome or piped to that salt dome from some other development, comes into closest contact with the effluent salt water of the oil well and through this vehicle may contribute appreciably its effects to the adjacent sea water.

5. Certain barium salts, because of their high specific gravity, are used in oil drilling operations through soft strata. As much as twenty tons of such barium salts have been used in Louisiana on a single salt-dome in a single year. The fate of this barium is not easily to be ascertained, but it is reasonable to believe that it must contribute appreciably to the effluent water or to the sea water. Instances are recorded in other states in which cattle were fatally poisoned through eating salt manufactured from barium-containing brines.

Oyster mortality may present decidedly puzzling problems inasmuch as oysters, in addition to other environment effects, are subject to the attacks of parasites such as the boring clam (*Martesia* sp.) and the boring sponge (*Cliona* sp.). Considerable changes in general precipitation may also modify the environment in the shallow coastal waters to such a degree that this single factor may exterminate the oysters in considerable areas.

The pollution investigations here reported included surveys of the areas where damage was recorded. Experimental plantings in wooden racks were done with adequate controls set up in normal waters. The oysters used were secured from a completely unaffected region and were transported under favorable conditions. These preliminary experiments gave a clear cut differential mortality. A marine laboratory was established with running sea water and experiments were begun in which oysters were subjected to the effects of oil, the "sludge" from the oil tanks, the effluent water and the highly altered substratal material from the immediate vicinity of the oil wells. Adequate controls were maintained. Results were secured in a much briefer time than had been expected. The control animals exhibited a clear cut contrast. Only a single oyster of the fifty controls died in a period of four months. It was found that oysters exposed, not to the direct contact with the oil itself but to a flow of sea water that had previously passed through an oil film, exhibited heavy mortality reaching in some of the experiments to as high as one hundred per cent. Effluent water, even in low concentrations, was likewise found to cause the weakening and death of some of the oysters exposed to its influence.

It is the purpose of the present brief presentation of these facts to emphasize both the complexity and the importance of such oil pollution. It seems in the light of the observations so far completed to be a considered prediction that unregulated pollution by oil wells in shallow coastal waters will exterminate the oyster plantings adjacent to them. The serious character of such pollution is a function both of the complexity of the chemical agencies involved and the possible long period modifications which the incorporation of these substances into the substratum may produce.

Oil pollution has been a gravely neglected subject. The literature is highly controversial. The experimental analyses available are highly inadequate. It is possible to derive from the literature completely opposed views, some investigators declaring that crude oil is harmless to marine life even when present in relatively high concentrations, others stating crude oil is one of the most toxic of all polluting agents. Such expressed views are almost invariably presented either without adequate experimental support or even without any experimental evidence whatever. It is not possible to resolve such diverse views into one pattern. It has been possible, however, to establish in the field and in the laboratory a definite relation between the presence of oil and oil well waste products and a mortality of oysters coincident in time and in space with such developments.

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The available research data are lamentably meagre in comparison with the importance and destructive possibilities of oil pollution.

The experiments herein reported were designed to analyze further the possible effects of crude oil and other oil well products upon oysters. Commissioner Robert S. Maestri authorized the establishment of marine laboratory facilities at the Department of Conservation Port of Entry, Grand Pass, Louisiana. The installation to provide this service included a Delco lighting plant as a source of power, and a Demy automatic pumping system for the circulation of sea water. The undesirable influences of increased concentration of various gases such as nitrogen, due to the fact that the sea water was being delivered under pressure, were eliminated by the insertion into each delivery pipe of an aerating device. Comparative tests of water thus treated with water drawn directly from the supply system proved that excess concentrations of gases were, by this treatment, removed. Aquaria were constructed having — litres, — gallons capacity and in them approximately fifty oysters of deliberately chosen different sizes were placed. These oysters were derived from local oyster beds on which no unusual mortality had been found. However, this stock showed a practically one hundred per cent infestation by the boring clam and the animals were therefore not in a very "fat" condition. Control oysters were maintained in one of the aquaria and exhibited a clear cut picture of survival, in spite of the boring clam infestation. Similar oysters, in a second aquarium, were exposed to a stream of sea water that entered the tank after passing through a film of crude oil derived from one of the oil domes investigated.

Difficulty was at first encountered, due to formation of large bubbles with oil as the external and water as the internal phase. Such bubbles bursting violently would project discrete particles of oil downward. The experimental arrangement was so revised that in addition to confining the oil in a vertically placed glass cylinder, this cylinder was provided with a large number of short pieces of glass tubing which, stacked in the lower two-thirds of the cylinder, provided an effective baffle for the oil and at the same time permitted free egress of the sea water through the cylinder, the water thus emerging from the lower end placed a couple of centimeters above the floor of the tank. It was arranged that approximately five hundred ccs. of sea water entered every tank per minute. The oysters in the third tank were exposed to a similar experimental arrangement in which the so-called "sludge" from the oil tanks was substituted for the crude oil. This "sludge", highly buoyant, also required the provision of a baffle arrangement of glass tubing. A fourth aquarium was so arranged that a control flow of effluent water, derived from the Lake Barre wells, was permitted to enter an automatic mixing device wherein complete mixing of the oil well waste water was accomplished before the resulting mixture was permitted to come into contact with any of the oysters. Additionally, there was set up a brief series of experiments in which oysters of the same stock were placed in one set of jars on normal substratum, in another set of jars on the substratum obtained from the immediate vicinity of the Lake Barre oil wells, a material having a definite odor of oil and an obvious oil content. These, too, exhibited a differential mortality.

The described set of experiments was carried to a successful and significant conclusion. The experiments were then extended so that a greater number of the oysters could be subjected to selected conditions and, at the time of writing, these expanded experiments, as well as other investigational methods, are being pursued by the Department of Conservation, in order that further light may be shed upon this highly important problem.

The Department of Conservation has received, in its investigation, generous co-operation from the State Board of Health in the conduct of certain chemical aspects of the work. Especially valuable has been the assistance of the State Analyst, Mr. Cassius L. Clay.

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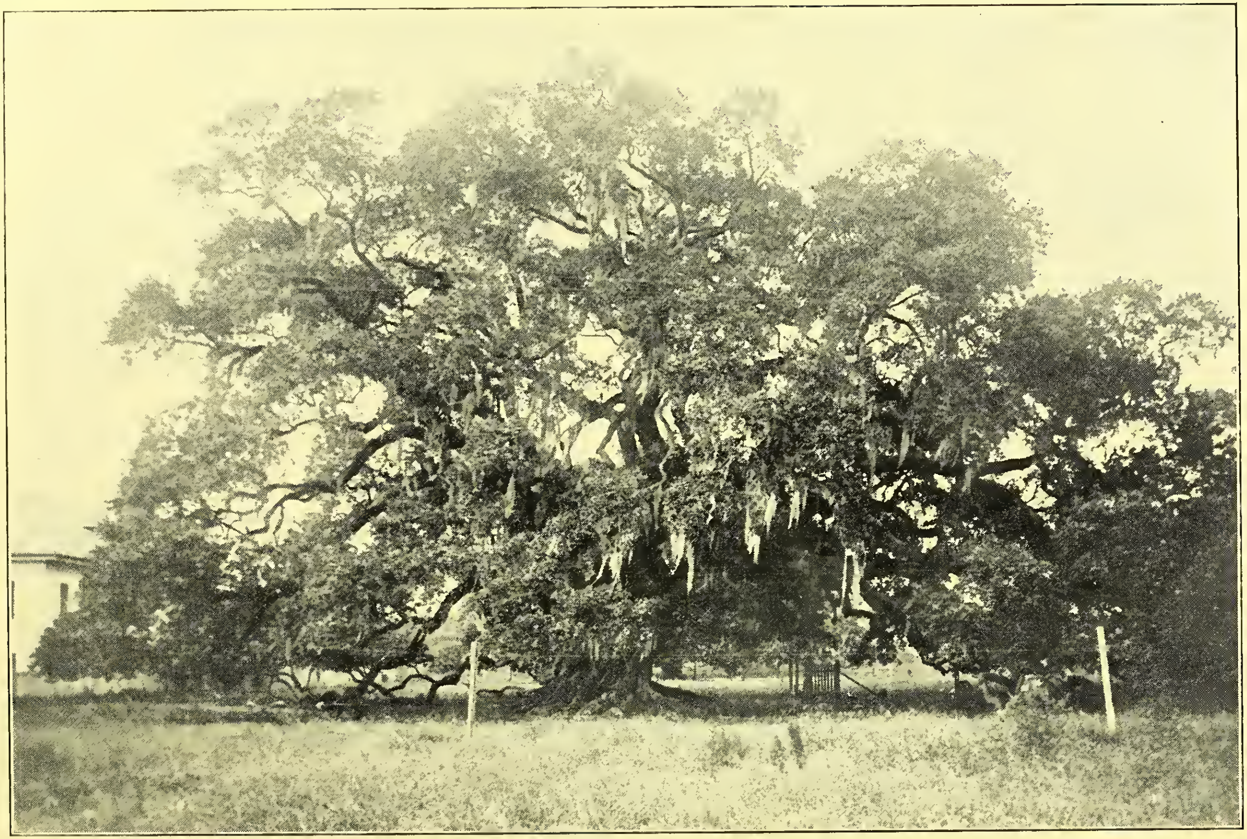

The Locke Breaux Live Oak, on the right bank of the Mississippi River, four miles above Hahnville in St. Charles Parish, Louisiana—just across the river from the great Bonnet Carre Spillway, and about a hundred yards below the mast of the "High Line" which crosses the river at that point. Circumference of trunk four feet above the ground, 35 feet; height, about 75 feet; spread about 166 feet. See article, "I Saw in Louisiana a Live Oak Growing", by Dr. E. L. Stephens, which appears in this issue.

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